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The Competent Minority

IN NO part of his message to Congress did the President express more sober truth than in his opinion that the problem of Muscle Shoals has received attention "all out of proportion to its real importance." And yet in the next sentence he states that "It ought to be developed for the production of nitrates primarily, and incidentally for power purposes," thus showing that even the Executive needs competent advice on ever so minor a matter.

INCIDENTALLY, the President could have assured abundant light for himself and Congress had he given heed to all his appointments on the Muscle Shoals Inquiry which has just made two reports. The majority of the commission were not competent to serve in a matter so charged with engineering and technical problems. Only the minority were suitably equipped for the job, and unless their voice now gains a respectful hearing the problem will remain as vexed as ever.

THE majority report is wholly qualitative and merely an expression of opinion by laymen. The sole investigation reported was on the probable cost of manufacturing "improved fertilizers" at Muscle Shoals, from which the conclusion was reached that "agriculture may very reasonably expect to secure concentrated fertilizers from Muscle Shoals at a material reduction below prices of the same plant food as now furnished." There is no novelty in this opinion, which is of doubtful value since no data are given. Private operation is wisely preferred by the majority, but the folly of government operation is recommended as a last resort. The power and nitrate plants would be leased as a unit, despite the fact that they have no essential relation to each other. The old economic fallacy persists of requiring the lessee to manufacture a fixed quantity of fertilizer at a limited profit, and the final evidence of incompetence is found in the assurance that "fortunately, the plants are of such a character that they can render an important peace-time service to agriculture."

ONE leaves the majority report with a sense of its futility and turns hopefully to the minority report of the engineer members of the Inquiry. First, the inadequacy of the majority plan is shown with respect to the very points for which it contends, namely, cheap fertilizer through cheap power and the assurance of cheap power for the manufacture of products useful in national preparedness. The power facilities are analyzed and evaluated, and the probable cost of power is given. Nitrate Plant No. 1 is shown to be useless for fertilizer manufacture and no asset in the national defense. Nitrate Plant No. 2 is not a fertilizer plant as it stands, but is potentially useful as a munitions plant and should be so maintained for a time.

THE minority sets its face against government operation and recommends separate private leases for power and fertilizer or other chemical production, since the two are utterly different propositions. Power should be reserved for experimental production of fertilizer materials by new processes until it can be determined whether cheap power will cheapen fertilizer production. Power should also be reserved for the manufacture of electrochemical or electrothermic products necessary to national preparedness, and in any event not wholly diverted to public utility purposes.

DEFINITE congressional agencies to carry out its proposals are recommended by the minority, one to negotiate the lease for power and one to deal with prospective manufacturers of fertilizers or products useful in national preparedness. Safeguards are suggested that will insure progressive reduction in cost of power to the consumer, and the production of fertilizer, if at all possible, at the lowest cost. In short, the report is a quantitative engineering study of a technical problem by qualified fact finders, and in our judgment Congress will be well advised to heed the proposals of the competent minority.

What Industry Expects of Congress

CHIEF among the accomplishments which the country expects of the Congress now in session in Washington is conservative but nevertheless constructive legislation. There is wide approval, however, of the President's view that our present state of prosperity "is more in danger of being retarded by mistaken Government activity than it is from lack of legislation." Industry, in particular, is asking to be left alone in its efforts to sustain the present high levels of production and to continue its gains in the direction of more economical distribution.

Fortunately for the success of the President's appeal for moderation and good business judgment, the 69th Congress is to be guided by leaders in whom industry is willing to place its trust. In the House, Speaker Longworth has already demonstrated qualities that will make his leadership invaluable and he will be ably assisted by the new majority leader, Representative Tilson of Connecticut. The chemical engineering industries seem especially favored in having these two men at the helm who are thoroughly familiar with their peculiar problems. And in the Senate the leadership of the Vice-President promises to be more than titular. It is to be hoped that his influence will act as an accelerator for increasing the production efficiency of that slow-moving and deliberate body.

Without detracting from the greater national and industrial significance of tax reduction, the framing of the budget to effect further economies in government, and the attention demanded by other foreign and domestic problems, there are a number of less important questions which directly concern the chemical engineering industries. That hardy perennial, the problem of Muscle Shoals, is again up for solution, but this time with fair prospect of settling once and for all the several issues that have been exaggerated so far beyond their real importance. This problem, as well as the one precipitated by the President's request for the Senate to ratify the Geneva protocol for the prohibition of the use of poison gas in warfare, is the subject of editorial comment elsewhere in this issue.

Of other industrial matters awaiting attention of the Congress, few are of more importance than are the legislative recommendations urged by Secretary Hoover in his annual report. To withhold support for carrying further the campaign of waste elimination is to handicap a great national movement that has already brought tremendous benefit to the general public as well as to industry. The furtherance of this campaign requires strengthening of departmental machinery and the broadening of its influence. One of the means is to provide legislation that will authorize the Census Bureau to extend its statistical service by collecting and publishing more data on current consumption, stocks and sales as well as on current production. The need for this information is of paramount importance. Mr. Hoover has also repeated his appeal for adequate physical facilities to house the department. For instance in the case of the Patent Office, recently transferred to the Commerce Department, the antiquated building is not only handicapping efficient procedure, but represents a serious fire hazard to patent records that are irreplaceable.

The Congress has another opportunity for further improving our patent system by granting a necessary and well-deserved increase in the salaries of federal judges. These men, who are the final arbiters in adjudicating the validity of patent grants, have long been underpaid. Unless these positions are filled by men of highest caliber, a breakdown threatens the entire structure of our patent system.

These are some of the problems on which industry is hopeful of Congressional support and understanding. Their solution should not be delayed by party politics or petty partisanship. Rather, in the words of President Coolidge, it is an opportunity "to translate principles into action, to have our country be better by doing better."

Chemical Warfare and The Geneva Protocol

IT IS difficult to eradicate first impressions or to reform opinion in the light of new knowledge. Thus when the Germans first used chlorine as a weapon of offense the world was horrified and promptly condemned the act as an atrocity in what we are curiously pleased to call civilized warfare. But as the art of gas warfare developed and experience was gained with its effects, it was difficult to persuade many that it was even more humane than the accepted forms of offense. And yet such are the facts deduced from experience in the World War.

These things are well known to technical men who realize also the futility of attempting to abolish chemical warfare and the illogical position of those who advocate this step. Warfare always has adopted, and probably always will adopt, the devices with which men have been familiar in their peaceful pursuits. They use the things they know; and in the heat of conflict and the emotion of self-defense resort to new and untried weapons, always seeking to surprise the enemy. In this way gunpowder, high explosives, the submarine and airplane, gas and smoke, have been developed. Nevertheless, in the face of these conditions there are those who would commit the United States to an abandonment of chemical warfare. The Washington conference on disarmament adopted a futile resolution opposing gas warfare which was jockeyed through the conference in opposition to the views of an intelligent committee appointed to report on the subject. The agreement has never been ratified by all the signatory powers and is ineffective.

The latest effort of the same sort is the so-called protocol adopted by the Geneva conference on international traffic in arms, at the suggestion of Representative Burton sitting for the United States. This will come before the Senate for ratification during the present session and should be defeated as futile and ineffective. It can be defeated without in any way affecting the remainder of the agreement regarding traffic in arms, as it is a non-essential and wholly gratuitous part of that pact. Why clamor loudly for improving our air defense and then take away the means of making that defense effective? Why not outlaw shrapnel and machine guns that maim and disfigure and fill our post-war hospitals? Better still, why not outlaw war itself as uncivilized and barbarous? Gas, smoke and airplanes are the most modern arms of the military establishment and should be maintained until national defense is no longer considered necessary.

Scope for Initiative and Inventiveness

ATTENTION is drawn in our Book Review pages to an intensely interesting volume, "The Creative Spirit," which has been written by an educator of broad experience. The appearance of the book is yet another proof of the exceptionally high plane of the best in American literature, as evidenced in painstaking analysis, orderly deduction and scholarly exposition. As outlined in the preface, the purpose of the book is to discuss the importance of a man's inclinations to pioneering, to invent, to take apart his surroundings, and even his inner life, and reshape it into something significantly new. The conclusion is reached that "in America, where we boast of being especially concerned with progress, creative-mindedness is usually neglected, it is often positively stifled, and it is not infrequently treated as a symptom of grave disorder."

In an introductory section the author defines the "creative spirit" and discusses its significance and influence on conduct. The church, we are told, should preach the doctrine that the truth must be sought, at all costs; and that the establishment of fact cannot harm a cause that is well founded. The author is critical of ministers who "strive to keep men's minds pleasantly closed," and "who make facetious remarks about the futility of intellectual inquiry." The church, moreover, should seek to promote social justice, not ignore its duties in this respect.

Education, we agree, too often lacks the "quickening" teacher. Many a university organization suffers from inadequate co-ordination; and the teacher fails to elicit a helpful spirit of sympathy in his problems and aspirations. Bigness, we read, is not always a sign of health; it often leads to fatty degeneration. "If we should become gravely and earnestly concerned with the making of smaller, less cumbersome units in education—units in which the individual need be neither coerced nor lost—we could find means of doing so." It is even proposed that the system of individual colleges in vogue at the two leading English universities might be employed as a point of departure. In other words, a redistribution is favored, which would not involve a duplication of work.

Industry, it is maintained, is the greatest disintegrating force in present-day social life. Moreover, it fails to encourage the slightest glow of inventiveness. The fate of a showing of the creative spirit on the part of an average employee, in the development of a detail that perhaps is worth nothing to the company but is rich in possibilities for mankind, is pictured. The physiological results of "speeding up" and the benumbing effects of monotonously intensive effort are responsible for much that is the object of harsh criticism.

The scientist is largely responsible, claims the author, for the customary attitude toward his work. His unconcern in other matters, which estranges him from those who should appreciate what he is doing but who seek an understanding of it with "too trivial facility," should be remedied. He shrinks from the cheapness of popular prattle or from the unfairness of popular disdain, and looks for solace in the land of scientific dreams. He has had the hard task of presenting new ideas seemingly in conflict with something sacred in the minds of most men. As a result he has developed an anti-religious complex. The church, the author mentions, has been the open enemy of modern science. It is therefore natural that the scientist should endeavor to get along without the church; or, further, to make scientific method a competitor of religion or a substitute for it. Science, we read, "offers to men one of the greatest opportunities for the kind of exploring which brings to them a satisfying realization of existence. . . . The scientist must bring to his work the emotional warmth which every great quest requires; yet he must be ready to put aside in coldest blood any evidence that is insufficient or untrue." He must scrutinize, weigh, compare, accept, revise or discard disinterestedly —a process of infinite difficulty. When the scientist tells the layman, "and tells him as though he cared for his case, how he might enter into the experience which the scientist himself enjoys; and when he is careful to show that science with her imperfect methods would not presume to be the ultimate philosophy of life, but only one of the approaches, the layman will have his life wholesomely colored by the habits of accuracy and the 'complete surrender' of the scientific method, yet he will feel free to do exploring and believing on the initiative of inner authority. And in the enlightened power of such a life there is hope for a human perfection which we have not yet known."

Patent Law and Federal Judges

CONSIDER the federal judges in their relation to industry. They have sole jurisdiction in the adjudication of patents and are thus an integral part of our patent system. Their worth and ability increase vastly with years of service because few of them have had patent experience when they accept their appointments, which, incidentally, are practically for life or during good behavior. The greatest care is exercised in their selection so that the honor, integrity and ability of our federal courts will be above reproach and a guarantee of justice to industry.

And yet we learned recently of a deplorable situation among federal judges due to that old quarrel with the government—inadequate pay for its professional employees. We have long known of low salaries for government scientists, technologists, patent examiners and men of that class, but we were not aware that federal judges, who bear such an intimate relation to industry, were so underpaid as to jeopardize the efficiency of the federal courts.

Apparently such is the case, and federal judges are resigning their positions, particularly in the large cities, because they can not maintain themselves and their families in reasonable comfort on the meager government salary. The matter is further complicated, as usual, by the marked contrast between their earning capacity in private life and their present income.

The condition warrants the attention of the chemical engineering industries to the extent of urging Congressmen and Senators to support current bills to increase the salaries of federal judges. We are now pursuing a penny-wise and pound-foolish policy in compelling capable judges to leave public service against their personal wishes. Continuity in office is a prime requisite for the best results. New judges are inexperienced, and frequent changes defeat the wise plan on which the federal judiciary is based. The condition should be remedied forthwith, and industry should play an active part in the process.

Beauty at the Works

"GAS house gangs" and the works from which they acquire their title have never been regarded as particularly good neighbors. During recent years, however, the gas industry has been setting a commendable example in plant maintenance and equipment from the standpoint of neighborliness and good appearance before the public.

Many chemical works suffer under the same inherent difficulty as the gas works, in that characteristic odors escaping into the atmosphere seem unavoidable. Many such works have in the past thought that the discharge of badly polluted waste waters could not be prevented. And then "insult" to public good taste has been "added to injury" by the construction of disreputable looking buildings and ugly unpainted fences and the maintenance of scrap piles of unsightly character along public highways or near important business or residential districts.

Times are so changing that it is now recognized that this is not a suitable policy of public relations. Unfortunately not every one has got in step with the new procession toward public good will. A word to the wise is sufficient. The unwise will probably not heed, but neither are they likely to remain long successful in business in these days of keen competition.

Relation of Consumer Demand To the Cost of Distribution

DURING "Management Week," held recently in 100 cities of the country under the auspices of most of the large engineering societies, much emphasis was put on the wasteful methods of distribution that prevail in many industries. In this connection, consideration was given to a number of means of improving distribution, including the collection of better trade and production statistics, the improvement of trade relations, the use of sound market analyses, reduction of the expense of doing business and the improvement of transportation as affecting distribution.

All of these factors have, without doubt, an important place in any movement to reduce the waste incident upon distribution. But, if we look beyond the immediate to the underlying causes of the waste that certainly obtains, it seems probable that we will come much nearer to finding a practical method of reducing this loss.

Such a survey will show that, in a large majority of cases, wasteful practices in the distribution of industrial products have resulted from consumer demands. Multiplicity of grades and styles, cross-shipments of goods, confusion in selling conditions that makes the collection of useful statistics difficult and sound market analysis almost impossible, and ruinous competition, are largely due to bad buying habits on the part of the ultimate consumer. In a highly competitive market, the producer is forced to cater to the wishes of the consumers of his product and if waste results from this condition, then it may be said that the fault is not entirely his.

We are faced, then, with the necessity of educating the consumer in his demands to an extent that will make possible the reduction of the cost of distribution. This means that such customs as seasonal buying, demand for large variety in styles and grades, purchasing from non-producing factors, demand for competitive goods produced other than locally and other similar buying habits must be educated out of the consumers. Perhaps the game is not worth the candle, but if it is, such education is the first price that must be paid.

Technical Progress and The Utilization of Ideas

A DISTINGUISHED consulting metallurgist, in publishing details of a process developed for a large concern, concludes with an acknowledgment of co-operation on the part of company technicians, which he characterizes as "particularly gratifying to one coming from outside the regular company organization with a method competitive with successful preceding work along the same lines." This acknowledgment leads one to infer—and the inference is a logical one—that such co-operation is rare: Disguised or undisguised hostility is the usual attitude toward the outsider in such instances.

Many apt quotations can be recalled that tersely emphasize the value of a fresh survey of facts and an alternative scheme of deduction, especially if coupled with the application of inventive ingenuity. Yet the average outsider has a hard task to get fair recognition or adequate reward, largely because of the obstructive tactics of members of the interested organization. The recent Supreme Court decision in the case of G. C. Carson *vs.* American Smelting & Refining Co. is an instance. In this case, however, the patentee's rights were recognized at an early date, and an offer was made with a view to purchase. The worth of the Carson modification in reverberatory-furnace practice was evident; and its cash value could be estimated at several million dollars. The price proposed, however, was contemptuous—$3,000. Carson declined to accept the valuation, whereupon the company decided to ignore his existence and his patents. To assert his rights, he has been obliged to forfeit a large proportion of reward in return for the enlistment of financial aid. The case has been finally decided in his favor, the legal costs incurred by the defendant company already aggregating several hundred times the amount that would probably have satisfied him in the first instance. And an accounting of royalties due is yet to be made, in connection with which the sum of $20,000,000 has been mentioned, which is by no means exorbitant when attention is drawn to the operating advantages of the innovation covered by the patents.

The independent inventor is recognizing that a patent merely gives the patentee the right to fight—at an expense that is invariably beyond his means. The rank injustice of existing conditions was brought home to us recently. A consultant in our own particular field, who has contributed materially to the more efficient and more economical application of a certain unit-process principle, brought his improvement to the notice of a large concern whose efforts in the same direction have been attended with heavy outlay and unrelieved disappointment. His proposals failed to elicit any apparent interest. A decent interval of time was allowed to elapse. Now the company is making feverish efforts at experimentation, with a view to

utilizing the idea underlying the consultant's improvement. From company officials comes the opinion that it will be possible to "get around" the consultant's patents.

The time is ripe for a housecleaning and the compulsory retirement of a certain type of technician-executive who, standing immovably on one rung of the ladder of success, near the top, does little himself to advance the art, and blocks the way for those with more initiative. History is proving that although contempt for the outsider and the thieving of the outsider's ideas may seem attractive and profitable, justice and a fair deal for all is good business in the end. Financial success is the sequel to technical improvement, and technical improvement is only possible if worth-while ideas, from every possible source, are encouraged to the limit.

Co-operative Effort for Insurance Economy

ONE OF THE noteworthy committee reports at the recent meeting of the American Gas Association was rendered by the insurance committee. During the preceding year that committee under the chairmanship of J. G. Reese, of the Baltimore Consolidated Gas, Electric Light & Power Company, had made possible a saving to the gas industry of many thousands of dollars. Furthermore, the committee had extended the insurance protection afforded to cover risk from explosion as well as fire risk.

The procedure to gain these two ends was so simple and so obvious that one wonders why it had not been accomplished before. But apparently it went unattended until just the right man came along to tackle the task. The ratio of losses incurred to premiums paid by gas companies was compared with the general industrial ratio by the Association committee. It was demonstrated to the satisfaction of the insurance rating bureaus that the charges against gas companies were unduly high in proportion to other industrial risks. A 25 per cent saving on certain classes of policies was obtained and on other classes of policies nearly one-third reduction in premium charge was made by reclassification of the gas industry's risks.

Previously fire policies had not provided against loss by explosion. Hence in many cases there was doubt as to whether any insurance protection existed against the loss incurred when both fire and explosion caused damage. In other cases where only explosions occurred there was no insurance protection. The insurance committee of the Association was able to correct this situation by having written in on fire loss policies a clause providing for the inherent explosion risk incident to the manufacture of gas. This addition, it is important to note, was made without any increase in the premium charge.

Numerous other industrial groups have the same fire and explosion problems as are encountered in the manufactured gas business. The success of the American Gas Association's insurance committee at once suggests that the corresponding committees for other trade association groups may not have realized all the possibilities which are before them. A 25 or 30 per cent saving in insurance with added protection is certainly something worth real effort to secure.

Responsibility for Control Equipment

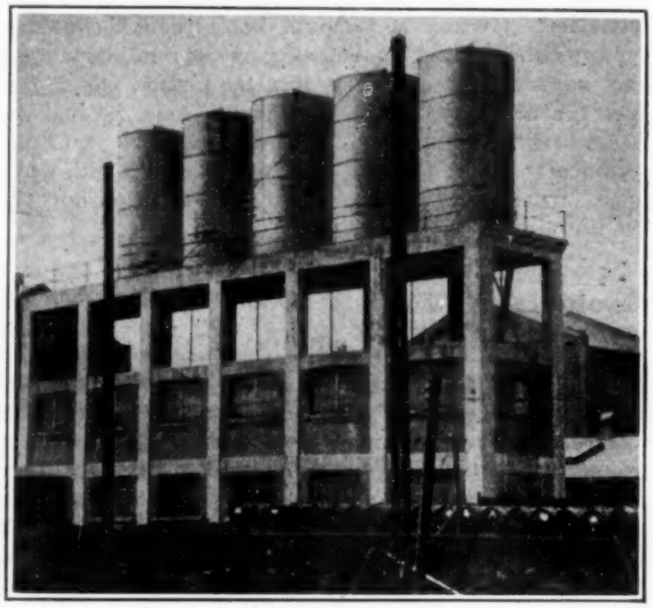
ONE large manufacturer of control devices with whom we were recently discussing the time-worn question of the cost of service for installed equipment declared that this factor, more than any other, had led his firm to discontinue the marketing of an otherwise successful carbon dioxide recorder. The case described may have been somewhat extreme from the maker's viewpoint, but it seemed to point to a situation which the user of the equipment must eventually take into account. The care and maintenance of plant control devices, if they are to serve their function efficiently and economically, should be placed in capable hands—preferably in the hands of the technical man familiar with their operation.

This manufacturer had found that it was impossible to charge much more than $100 profit on a single installation of his carbon dioxide recorder. This included instruction necessary to familiarize the operator with the use of the instrument. If this latter task had been well done, in all probability the device would function satisfactorily for several years and the customer would not ask for service from the manufacturer. Then, perhaps, an inexperienced operator would be put in charge of the instrument and through ignorance or carelessness the device would cease to give results. A call to the manufacturer would follow and his service man would have to go to the plant, make the repair or adjustment and again explain the operation of the equipment. The expense of this service at first seemed trivial, but the manufacturer soon found that it was averaging more than $10 per year per instrument. Now, it does not require a slide rule or a table of logarithms to show that profits evaporate within ten years on such a basis. Nor is it strange that the manufacturer saw fit to make a change in his sales policy.

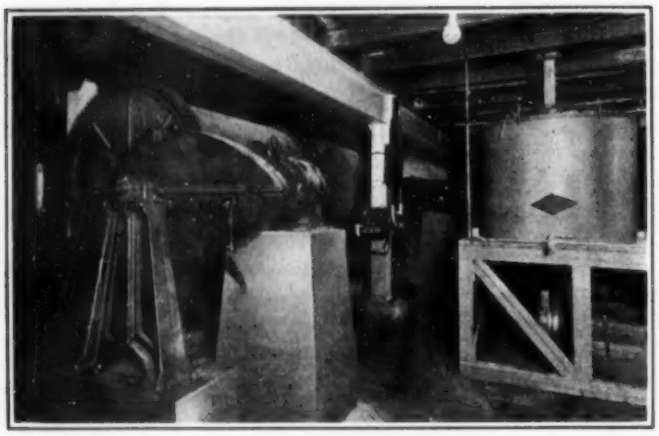
It occurred to us that if the control equipment had been handled by the system used in one of the large coke plants, which we recently visited, the service problem of the manufacturer would have taken on a different aspect. Here a special division of the laboratory personnel, reporting directly to the chief chemist, has charge of all instruments as well as records and charts. The men who make up this division have by training and experience become experts in the maintenance and repair of the recording and indicating instruments, whether mechanical, electrical, or chemical in principle. Their skilled technique makes it possible to get the maximum usefulness from the equipment—in any plant a worth-while economy, but in coal carbonization the intelligent use of such instruments is a prime requisite for profitable operation.

Obviously, few plants can set up a laboratory division for instrument control or even allow a single individual to give his entire time to the matter. Nevertheless the principle can be much more universally applied. The technical man's familiarity with the construction of the instrument and his competent knowledge of its operation make him the logical man to be responsible for its control and maintenance. And this responsibility, if properly discharged, will not only increase the value of the control equipment to the user but in a like measure will decrease the service difficulties of the instrument maker.

Significant economies were effected at the plant of Baer Brothers in Stamford, Conn., by the introduction of modern methods and equipment for material handling and for process work. The view at left shows one end of the 5-story warehouse, with its convenient loading platform and railroad siding. Below are the elevated tanks for oil storage. Located directly beneath these tanks are carpenter and general repair shops.



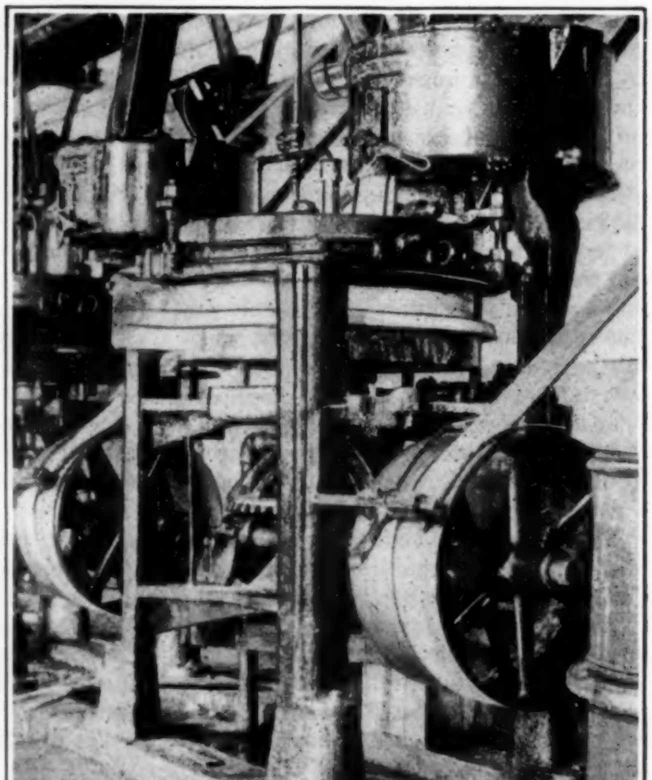
Equipping the Paint Plant for Efficient Production



ABOVE — *A 900-gal. pebble mill with individual motor drive.*

BELOW — *Belt-driven mixing machines for mixing pigment with a small amount of liquid preliminary to grinding.*

BELOW — *One of the 40 buhrstone grinding mills is shown here, with the feeding hopper above it and the chute for bringing the material to be ground from the floor above.*



Applying Modern Production Methods To Paint Manufacture

Modernizing the Stamford Plant of Baer Brothers Involved the Solution of Management Problems in Material Handling and Selection of Mechanical Equipment

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FROM THE VIEWPOINT of the manager, the manufacture of ready-mixed paints and enamels involves two sorts of problems. First, because of the large supplies of raw materials, both liquid and solid, which must be kept on hand at all times, and the necessity for packing the finished product in great numbers of small units, the manager of the paint plant is faced with the problem of providing and systematically co-ordinating a wide variety of material handling equipment. Second, because the finished product must be completely prepared for distribution to the ultimate consumer in a highly competitive market, production must be so efficient as to take advantage of every possible economy in manufacturing process. Naturally this involves the proper selection of the most modern mechanical equipment and a sustained effort to keep operation on a highly efficient basis.

An unusually effective solution of just these problems is to be found in the plant of Baer Brothers at Stamford, Conn., which at the present time is equipped to produce approximately a million gallons of paint per year. During the past 18 months and largely due to the management of Fred H. Lane, the volume of production has steadily increased, the quality of the product improved and the cost of manufacture declined. To indicate some of the methods by which this has been accomplished is the purpose of this article.

Handling and Storing Materials

In a paint plant where production is on a large scale, it is essential to carry supplies of all important raw materials for 4 to 6 weeks in advance. This must include even cartons and box shooks for shipping finished products. In order to handle such quantities of materials it is necessary to have storage space at least as great as that required for manufacturing. Fig. 1 shows the layout of the buildings used for these two purposes and the photographs show how the railroad siding is located with reference to the loading platform and storage building.

Liquid raw materials consisting of oils, volatile thinners and grinding liquids, are delivered either in tank cars, carrying from 8,000 to 10,000 gal., or in barrels or drums, carrying 55 to 110 gal. The volatile liquids, being flammable, are stored in underground tanks filled by gravity direct from the tank cars. All pipes leading from the railroad siding to either underground or overhead tanks pass through a meter in the pump house to check shipping invoices (see Fig. 2). There are two of these underground tanks, each of 12,000 gal. capacity, for petroleum spirits.

The oils are pumped direct from the tank cars to the elevated tanks shown on p. 910 which are also metered. There are two grades of oil carried in stock and there are five 15,000-gal. overhead tanks. Thus there are two tanks for each grade with one spare. As soon as the supply in one tank gets low, an order is placed for a new carload. By having the tanks of considerably greater capacity than that of the largest tank cars it is not necessary for a tank to become empty before accepting delivery of a new consignment, thus avoiding delay, annoyances and possible interruption of production because of lack of raw materials. This applies to both underground and overhead tanks.

The most serious storage problem is in regard to the dry raw materials. This is because in the manufacture of paint, use is made of gravity in so far as possible, in progressing from one stage of manufacture to another. Consequently the dry raw materials are first mixed with liquid on the top floor of the manufacturing building whence they descend, by gravity, to the next floor for grinding, and so on.

The top or fifth floor of the warehouse is used for the storage of cans, of which several car loads are kept on hand, and the fourth floor for labels, cartons, and boxes. All of these have to be carried down to the first and second floors where the labeling and packing is done—the machine labeling and packing of straight lots is done on the first floor and hand labeling and packing of odd cases on the second. This is convenient because the finished goods are readily brought in from the lower floors of the factory. It will thus be seen that the third floor of the warehouse, corresponding with the top floor of the factory, is left free for the storage of dry raw materials for paint

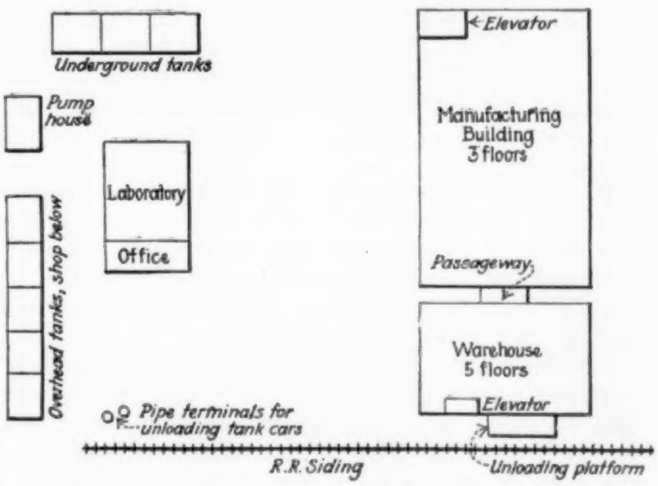


Fig. 1—Layout of the Paint Factory of Baer Brothers, Stamford, Conn.

and the small supply of liquid material in barrels necessary for the first "mixing" process.

The manufacturing operations of mixing or chasing, grinding, reducing and shading, and straining and filling are each carried on by means of more than one kind of machine in this factory. As new machines have been perfected for various processes, the manager has not hesitated to use them for the replacement of worn-out equipment or for increases in productive capacity. There is, consequently, an excellent opportunity here to compare the advantages and disadvantages of the various types as well as to record their performance under good management.

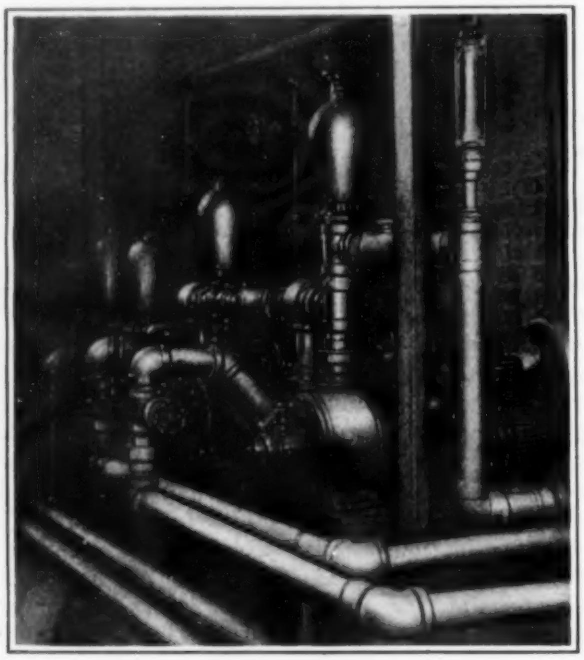


Fig. 2—Meter and Pump House
All liquid raw materials pass through this house as they are unloaded from the tank cars so that the quantity may be metered as a check against invoices.

Selecting Production Equipment

Mixing or Chasing.—The mixing, or thorough incorporation of the pigment with a portion of the vehicle for any given product, is accomplished by power-driven agitators in tanks 24 in. high and 36 in. in diameter, having a daily capacity of about 2 tons of paste each per day. These mixers are located on the third floor of the manufacturing building and the dry raw materials are kept on the corresponding floor of the warehouse, with a bridge between; and the liquids are piped to the mixing floor directly from the outside storage tanks. There is one mixer for each of the 40 buhr-stone mills on the floor below.

In addition to these mixers there is one "chaser" (made by J. H. Day and Co.) which combines mixing and sufficient grinding for the manufacture of white-lead and white-zinc pastes and putty. This one machine, driven by a 25-hp. induction motor, has a capacity of 2½ to 3 tons per 8-hr. day.

Grinding.—The factory has three kinds of grinding machines, stone mills, roller mills and pebble mills. The 40 stone mills are located on the second floor directly below the mixers. It takes from one-half to one hour to mix a batch thoroughly after which it passes by gravity through a chute into the hopper over the mill on the floor below, where it is kept mechanically agitated while passing on to the stones. There are 33 single, flat-buhr stone, water-cooled mills for regular runs of paint, and 6 single, flat-buhr stone, water-cooled mills for colored enamels. The stones are 30 in. in diameter in the 33 mills and in the latter they are 20 in. There is one other mill, a 26-in. buhr-stone tandem mill for high-grade white enamel.

The capacity of these mills is an amount of paste sufficient to make an average of about 150 gal. of finished product per day. As the paste comes from the mill it is allowed to drip into wheeled tanks (see Fig. 6), each of which is fitted with hoisting lugs, outlet gate and a step in the bottom to receive an agitator. The significance of these details will be seen later when reducing and thinning is discussed.

There are six pebble mills, made by the Patterson Foundry and Machine Co. and equipped with individual electric drive as follows:

No.	Size	Capacity in Finished Product	Motor
2	5 ft. x 8 ft.	900 gallons	25 hp.
2	4 ft. x 5 ft.	450 gallons	20 hp.
2	2 ft. 6 in. x 3 ft. 6 in.	250 gallons	15 hp.

Morse silent chain and Link-Belt drives are used on these mills which are located on the ground floor because of their weight. The production of these mills, which run practically all the time, represent the bulk of the output. The other grinding equipment is used more or less for specialties. The contents of the two groups of large mills are, after grinding has been finished, pumped by means of motor-driven rotary pumps (Gould and Kinney) to storage tanks on the ground floor from which they are withdrawn by gravity for straining and filling. The pumps are driven by 10-hp. 220-volt induction motors.

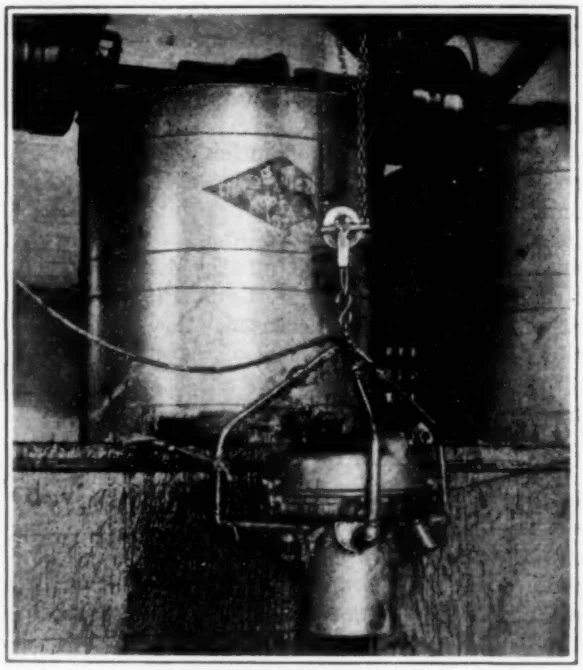


Fig. 3—Portable Vibratory Strainer
This motor-driven unit is shown attached to a tank ready for use. Note the flexible cord for attaching it to the most convenient lighting outlet.

Two 250-gal. pebble mills used for stock to be tinted are placed on concrete foundations at a sufficient height to permit of the wheeled tanks being backed under the outlet valve. The shading is done in these wheeled tanks and the finished product is then drawn directly from them for straining and filling.

At present there are only three roller mills in the plant, but this will be changed in the future. These mills are of the three-roller ink type (made by J. H. Day and Co.) water-cooled, with rolls 8 in. by 30 in. They are used almost exclusively for small batches of various colored products, both in paste and liquid, where rapid and frequent changing from one color to another is unavoidable on account of small volume of production. They are at present driven from the main

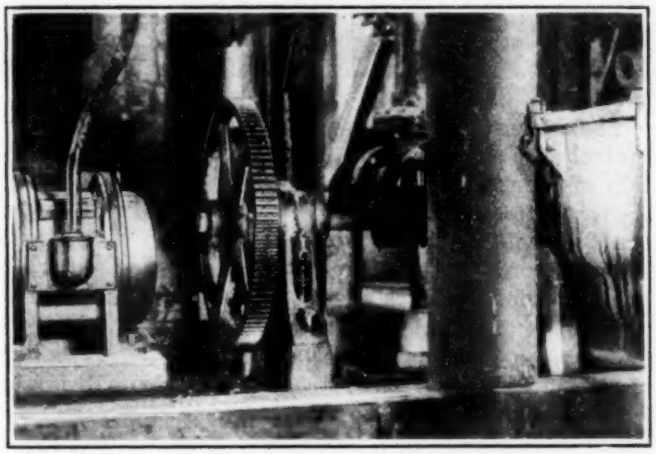


Fig. 4—Motor Driven Rotary Pump

This is used for pumping the contents of a pebble mill to the storage tank. It is located on the floor under the tanks and adjacent to the mill.

shaft but will later be equipped with individual drive The mills have a capacity of enough paste to make 200 gal. of finished product per day.

As the pigments vary in weight from 15 lb. per bbl. for lamp black to 600 lb. per bbl. for white-lead, the batches of paste for the mills are designed on the basis of volume of finished product rather than weight —the unit of volume is the capacity of a wheeled tank (150 gal.) after all the liquids have been added to make the finished product as described below.

Comparative Advantages of Different Mills

According to this plant's experience, the only satisfactory mills are those of the roller and pebble types. At present there are, as we have already seen, 40 stone mills in the plant, but as they wear out they will be gradually replaced by roller mills.

The stone mills can do nothing that the roller mills cannot do. They require constant watching because if the paste runs in too fast from the mixer, there will be an overflow, which means that some of the unground paste will be mixed with that which has been ground so that the whole batch will have to be ground over. If the feed is too slow, the stones become dry and burn. The result is that one man cannot properly attend to more than 6 stone mills at a time. Furthermore, the stones require frequent dressing (see Fig. 5) which means not only high maintenance but considerable shut-down periods. Perhaps the greatest disadvantage of all is the difficulty of cleaning stone mills when a change of color or formula is made.

The roller mills also require close attention and mechanical skill in evenly adjusting the pressure along the full length of the cylinders. The production of the roller mills used here is double that of the stone mills but the 3 roller mills in operation require the attention of one man so there is not much saving in labor. However, savings can probably be realized when more roller mills are installed. The great advantage is the ease and rapidity with which these mills can be cleaned. This alone makes them far preferable to the stone mills because it means greater flexibility in usage and consequently, less investment for equipment and floor space. The consumption of power per gallon of finished product is about the same for both types of mills.

Both stone and roller mills are now used only for making pastes and for this only because pebble mills are impracticable on account of the difficulty of cleaning and the loss due to so much sticking to the pebbles.

Pebble mills are ideal for the large-scale production of single colors, as in the case of white and tinted house paints and wall finishes. They are economical to run because the entire production of 3,200 gal. per day can be handled by three men. In fact, this can be doubled, as not infrequently a pebble mill is started near closing time and left for the night watchman to turn off. The production could be tripled by using a night force. They do not need to be watched at all, it being simply necessary to make a test near the end of the run to see if the grinding is complete and if not, to run the machine a little longer. There are no losses from evaporation, no danger of overheating, no separate mixing and reducing operations and no danger of coarse extraneous material inadvertently getting into the closed drum.

The 4 largest mills have now been in service for one and one-half years and have not needed any repairs, whereas both stone and roller mills keep a machinist

Fig. 5—Dressing Buhr Mill Stones

This is necessary at rather frequent intervals and is the cause of considerable expense. It also means extra investment in equipment for a certain number of these mills are always out of service.

busy all of the time. It is evident that these large, rather expensive, pebble mills would not be economical to use for small batches or for small-scale production but that they materially decrease the cost of production when it is carried on on a large scale.

Mixing and Agitating

The reducing and shading is done, as already explained, in the wheel tanks in batches of about 150 gal. of finished product. Of course materials from the pebble mills need only shading, but in either case care-

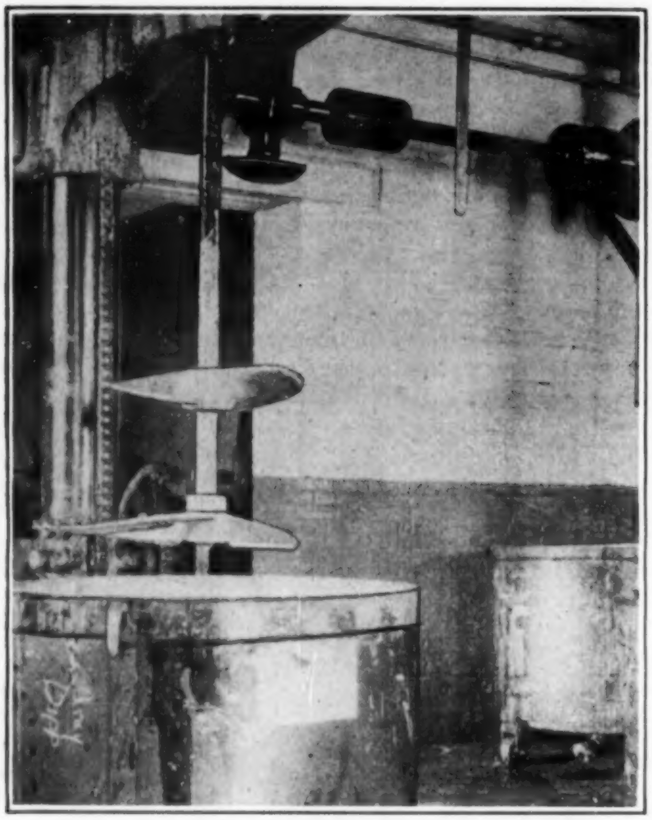


Fig. 6—Upright Column Change Mixer for Reducing and Shading

At the right is a second wheeled tank ready to be pushed under the column mixer.

ful mechanical agitating is required in order to secure proper mixing. In this plant there are eight upright column change tank mixers, which are electrically driven and can be lowered into the wheel tanks pushed under them, the vertical shaft fitting into a step. Each of these mixers which are made by Charles Ross and Sons, is capable of handling 1,000 gal., or six or seven 150-gal. batches per day which, with 8 mixers, greatly exceeds the output of the plant. Nevertheless it saves a great deal of time and labor to have several mixers and thus avoid too frequent cleaning for changes in color, etc.

Straining and Filling

All material withdrawn from the storage tanks for filling into final containers is strained in order to remove foreign particles rather than unground pigment. Vibrating sieves (see Fig. 3) made by the Vibrating Machine Co., in which the material passes through a paint hog with a 90-mesh strainer, are used. There are twelve of these operated by individual motors connected at any convenient lighting outlet. The capacity of these strainers is upwards of 1,000 gal. per day, depending somewhat on the nature of the material.

There are also two DeLaval centrifugal clarifiers which are used for the highest grades of enamel but for paints with heavy pigments, where the difference in specific gravity between solid and liquid content is consequently too great, these machines are not practicable.

It has been found that the ideal arrangement for the strainers and filling machines, is to make provision for moving the filling machines from one storage tank to another as the different products are drawn off from the latter. This might also apply to the labeling machines, if space permits, but in this plant it is best to take the filled cans to the packing room as explained in the previous discussion.

Careful study has been made of the type of filling machine best suited to the conditions in this plant. The verdict has been in favor of those operating on the plunger principle, delivering a measured amount to the container. This seems preferable to the weighing principle, because, not being dependent on the head of paint in the storage tank, it is the most accurate. This type of machine, which is made by the Positive Filling Co., is very easily cleaned and can fill from 500 to 600 gal. per hr.

The laboratory of this paint factory has absolute control over all operations having to do with the production of paint and is held responsible for its quality by the executive branch of the business. Its activities are divided into three parts in order to meet these requirements: *First.*—The inspection of raw materials and the adoption of standards. *Second.*—The laboratory keeps standard samples of each of the company's products on hand and tests samples of each day's run of every product against these standards. It is the only way in which uniformity of quality and appearance can be maintained. *Third.*—The laboratory has to provide the proper formulas for the manufacturing department. These must be slightly changed from time to time because of price variations in raw materials and changes in the raw materials themselves, due to improvements in the methods of manufacturing them. In this way it is, from time to time, possible both to improve quality and reduce costs, important matters in such a highly competitive industry.

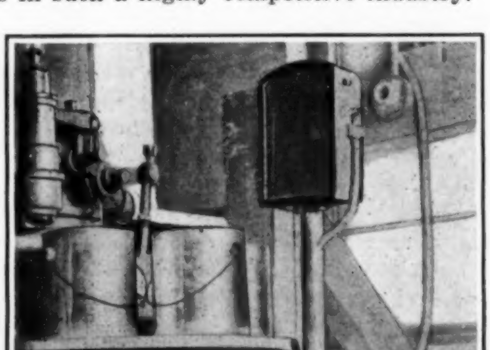


Fig. 7—Electrically Operated Filling Machine of the Plunger Type

It is drawn up to a storage tank ready for filling. At the right is the electric motor and the cord for plugging in at any lighting socket.

Grasselli Medal Award

Producing Clear Fused Quartz Electrothermally

Manufacture of Large Transparent Aggregates of Silica Made Possible by New Vacuum and Pressure Furnace

By Edward R. Berry
Assistant Director, Thomson Research Laboratory
General Electric Company

Dr. Edward R. Berry

NEARLY 90 years ago, or to be exact, in 1839, a French scientist, Gaudin by name, working with the high temperatures of the newly discovered oxy-hydrogen flame, was able to fuse or melt small fragments of quartz, obtaining fibers and small beads. I would remind you that Gaudin's work was made possible by the use of a flame of higher temperature than had before that time been available.

In the very earliest years of the nineteenth century, Sir Humphry Davy, in experimenting with a large Voltaic battery, happened to put two terminals of box-wood charcoal together and draw them apart with the current of the battery traversing them. This gave an electric arch, afterwards called an electric arc, and made possible higher temperatures than had ever before been reached by man, and the experiment itself was characterized by Davy in his accounts of it as a "glorious experiment."

In 1849, Despretz passed a heavy battery current through a small carbon rod buried in quartz particles, and found that in this way he could form a tube of fused quartz. This method survives in certain of the manipulations of quartz shapes, and was extended by Dr. Elihu Thomson and patented by him in December, 1904. These methods are applicable to quartz more or less clear and having moderate bubbles in it, or more or less translucent, there being no such thing as opaque quartz in reality, although in a loose way the term "opaque" has been applied to quartz not transparent owing to bubbles. Even in this case the quartz itself, if a particle be separated out, is found to be transparent.

About 30 years ago, Shenstone found that by heating quartz crystals to redness and quenching to crack them up, then melting them in the oxy-hydrogen blowpipe adding particle by particle, pieces of clear quartz of considerable size were produced with practically no bubbles. (Shenstone, *Proc. Roy. Inst.*, 1901, p. 525).

The facility with which electric heating can be applied, especially resistance heating, has changed the methods of production of both translucent, or so-called opaque quartz, and the clear quartz so greatly that the fusion can be carried out with relatively great facility, and even large masses produced. The Thermal Syndicate Company in England began the production of fused quartz about 25 years ago under the direction of Dr. R. S. Hutton, and adapted it to certain uses in the chemical industries. For example, the concentration of sulphuric acid was revolutionized, and vessels were made which resisted sudden heating and acids.

In this country, Dr. Thomson carried on work at intervals for about the same period back, applying his process of resistance heating. In all such cases there was inclusion of the bubbles in the masses melted, and the thing that distinguishes the transparent or clear quartz from translucent or loosely-named opaque quartz, is the presence of more or less bubbles throughout the mass.

When quartz is melted in the air, the water and dissolved gases that crystallized out with the quartz millions of years ago, are set free and manifest themselves in the form of microscopic bubbles. The translucent or common form of fused quartz, with which you have worked in your laboratories is not transparent, due to a multitude of bubbles. In other words, quartz is translucent for the same reason that snow is translucent due to a very great number of reflecting surfaces. One can perhaps visualize some of the difficulties encountered when one realizes that these bubbles are set free in a molten mass that is highly viscous—a material that never becomes fluid in the ordinary sense of the word. This viscosity, coupled with the fact that quartz vaporizes well below its melting point, and that at the temperatures which we find necessary to maintain inside our furnaces that the loss by volatilization is often as high as 20 per cent during a time period of 10 minutes. This will indicate, even to the casual observer, that the problem we have been working on is indeed difficult.

Although the so-called opaque variety is manufactured at will, and in a multitude of shapes, the clear material is produced under very great difficulties, due largely to the great number of bubbles that are formed when the fusion point is reached.

Boyle, you will recall, proved that the volume of a gas varies inversely as the pressure. It is, then, possible by fusing quartz in vacuo to so enlarge these gas

From an address before the American Section, Society of Chemical Industry, in response to the presentation of the Grasselli Medal, Dec. 4, 1925, in New York City.

pockets that they will take up many times the space occupied under normal pressure. In vacuo then, bubbles that heretofore were microscopic, become so large that in most instances they find their way to the surface and are set free.

The remaining bubbles, comparatively few in number, can be greatly diminished in volume, if not entirely eliminated, by allowing the pressure inside the furnace to greatly increase while the mass of quartz is still molten. This is accomplished by allowing nitrogen, or other gas, to flow into the container until pressures well over 1,000 lb. per sq.in. are obtained. In some cases pressures as high as 3,000 lb. per sq.in. have been used. The intensive work on the development of the vacuum furnace method of fusion was started in 1915.

In March I covered rather completely the technical development of fused quartz up to that time. Hence I shall tonight only touch upon the more recent phases of development, calling your attention to the progress which has been made since my last address.

Glass and Quartz Thermometers Compared

The use of mercury thermometers at temperatures well over 500 deg. C. constitutes a dangerous procedure, as the boiling point of the mercury must be raised by gas pressure inside the bulb and tube, and at temperatures much over this point the bulb becomes in substance a bomb which may explode with disastrous results. It is customary at these higher temperatures to make use of thermal junctions; that is to say, to take advantage of the e.m.f. generated at the contacts of two dissimilar metals, the readings being obtained from a milli-voltmeter calibrated in terms of temperature. Very often there is no particular objection to the use of such an arrangement; in fact, sometimes it is not only entirely satisfactory, but is to be preferred. Of course, the thermal junction, leads and milli-voltmeter are not interchangeable, and must be calibrated only with the arrangement which is to be used. It is safe to say, however, that in most cases one would prefer to use a "thermometer" of the ordinary glass-mercury type, were such available and accurate.

There is a very considerable hysteresis in glass which often makes it difficult to interpret readings. Although this property of glass does not play a conspicuous part at the lower temperatures, it becomes of increasing importance as one progresses upward in the scale of temperature. I have in mind some tests which were made in our laboratory, and which well illustrate the effect of hysteresis in glass. Two mercury thermometers, one of glass and the other of quartz, were placed in a bath of melting ice and their zero points marked. The thermometers were then, by way of a bath of fused sodium nitrate, raised to 510 deg. C., from which temperature the thermometers were cooled within a period of 3 hr. until zero was reached. The glass thermometer now read 1.5 deg. C. below the original zero point. Again the thermometers were heated to 510 deg. C. and again cooled to zero. This time the glass thermometer read 4.75. After a period of days, weeks, months and sometimes years, such thermometers will usually return to their correct reading, this lag being caused by the hysteresis in glass. I neglected to say that in all observed cases the quartz thermometer came back accurately to the zero mark.

I would call your attention to the temperature pressure curve of mercury from which you will observe that the curve is becoming rather steep around 500 deg. C. At about 700 deg. C., the mercury pressure is so high as to be entirely out of consideration for the purposes in mind.

Although we were able to produce heavy walled capillaries of sufficiently uniform bore for thermometer use, it is very evident that some substance other than mercury would have to be found and one which would have a much lower vapor pressure. This before a thermometer reading well over 500 could be produced.

New Thermometer Has Remarkable Features

While working with the mercury-quartz thermometer one of my assistants, Mr. Boyer, made a very valuable suggestion, namely, using gallium in the place of mercury in the quartz thermometer. I would call your attention to a curious phenomenon which really makes the gallium thermometer possible, namely, that gallium in the thermometer possesses the remarkable property of remaining liquid much below its solidifying point as established by well-known methods; for example, the freezing point of the pure metal is 29.7 deg. C.; contrast this now with the fact that in a thermometer it does not solidify at 20, which is indeed a very convenient property. The boiling point of gallium, although possibly not definitely known, is usually estimated at from 1,500 to 2,000 deg. C. Its vapor pressure is so low that the thermometers which have been made are all of the vacuum type.

A gallium-in-quartz thermometer, maintained at 1,000 deg. C. for a period of 24 hr., was not apparently injured in any way. 1,000 deg. C. is the highest temperature at which I feel it is advisable to hold quartz for any considerable period of time. I believe, then, that we have here an accurate thermometer which in a remarkably satisfactory way bridges that gap between 500 and 1,000 deg. C.

Although we have been able to produce directly from the electric furnace high-grade tubing and rod, the control of the operations has been difficult and unsatisfactory. We have more recently been able to perfect our processes whereby we can control absolutely the bore and wall thickness of tubing and at the same time have substantially improved the product. Until the past few months our sheet quartz has been produced largely by grinding and polishing slabs sawed from blocks of fused quartz. In such a process the losses were of course very great. Quite recently we have perfected a process of drawing sheet quartz directly from the furnace with very little or no loss.

Expenditures for Industrial Research

The following extract from a publication of the U. S. Chamber of Commerce, entitled "Cooperative Industrial Research" gives our estimate of research laboratory expense in manufacturing establishments.

"Notwithstanding the intangibleness of the monetary return on research investigations, the mere fact that manufacturers contribute large sums annually toward the carrying on of such work is evidence of its ultimate value to industry. In fact, some time ago a statement from one admittedly in position to judge, placed the amount expended annually by American manufacturers in the conduct of laboratory research alone at thirty-five million dollars. Unquestionably this figure is well on the conservative side. In addition, this same authority places the annual savings to American industry from research at one-half billion dollars."

How Sulphur Is Mined With Superheated Water

Frasch Process Used at Freeport, Texas, Requires Daily Heating of Four Million Gallons of Water

By W. T. Lundy
Production Manager, Freeport Sulphur Co.

TWENTY-FIVE years ago the crude sulphur requirements of the United States were supplied by imports from Sicily and Japan; while Spain furnished us with large tonnages of pyrite for the manufacture of sulphuric acid. Today the reverse is true and we see the United States producing 2,000,000 long tons annually; enough for all its domestic needs and leaving a balance of approximately 500,000 tons for export.

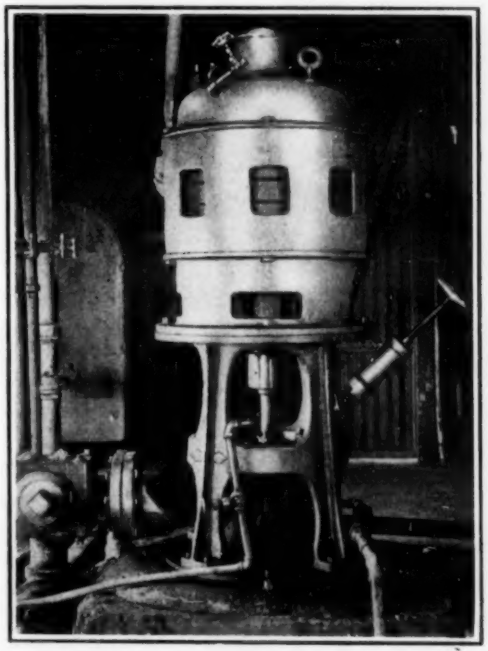
This change was brought about by the discovery, some 35 years ago, of sulphur in the cap-rock overlying the salt domes in the oil fields of Louisiana and Texas. The first attempts made to obtain the sulphur employed ordinary mining methods of shafts, levels and stopes but the poisonous gases encountered in the unconsolidated formations made them failures. Herman Frasch took out patents in 1891 covering a system of obtaining sulphur from these deposits by the method of heating water above the melting point of sulphur, forcing it down drilled well holes and into the porous sulphur-bearing rocks and then bringing the molten sulphur to the surface by air lift. The operations are rather involved and it took the Union Sulphur Co., the first operator, 12 years to perfect the process to a point where these deposits were any factor at all in the world sulphur market. In 1919 the Freeport Sulphur Co. began operations at Hoskins Mound, Texas, which is the latest deposit to be opened and the work there is the basis of this article.

Mining, Pumping and Storing

There are three distinct steps or operations in the process. *First.* Hot water, pumped down bore holes and forced into the deposit, liquefies the sulphur which is brought to the surface by air lift and discharged into relay stations. *Second.* Vertical centrifugal pumps, steam jacketed, lift the molten sulphur from the relay stations and deliver it to distant storage bins where it cools and solidifies. *Third.* The storage bins are stripped of their plank sides and the sulphur is drilled, blasted and then loaded into railroad cars by a locomotive crane bucket hoist.

The underground mining operation is simple to describe in general terms although rather complicated in its actual application. Approximately 4,000,000 gal. of water are brought daily from the source of supply some 5 miles distant. It is stored until needed and treated to remove permanent and temporary hardness and otherwise made applicable to the complicated system of boilers, heaters, pumps and pipe lines through which it must pass. Next it is heated in the pre-heaters and boilers to a temperature of 350 deg. F. and then pumped through pipe lines from 1,000 to 5,000 ft. in length to the underground strata of sulphur bearing material. Hourly tests are made by chemists as the water passes through a system of flow lines and measuring devices to keep absolute control of its properties. The heated water enters the wells, of which there are a great many, through a series of concentric pipes varying in size from 10 in. to 3 in.; the amount and pressure being regulated according to the requirements of the individual well. The hot water escapes through perforations in the pipes and enters the porous sulphur-bearing rock near the bottom of the strata. The temperature being approximately 350 deg. F., the sulphur is melted and when a sufficient quantity has accumulated at the bottom, part of the water is shut off and air under high pressure is sent down through a 1-in. line. The molten sulphur is brought to the surface by air-lift action and discharged into basins called relay stations. This completes the first operation in the process.

The next operation is that of handling the sulphur from the relay stations to the storage bins. This is accomplished by Layne, 5-stage, vertical centrifugal pumps, driven by 50 hp. vertical, direct connected motors. The pumps are designed and specially built for this severe service. The stages or bowls are steam jacketed to admit live steam continually in order to keep the sulphur from solidifying. The pump head is on a floor above the relay station and the bowls are directly below it, immersed in sulphur. This type of pump is commonly used to supply water for industrial plants from deep wells and was selected for this work because the line shaft connecting the pump head with the impellers is entirely enclosed and does not come in contact with the liquid sulphur. Furthermore the impellers are at or below the level of the liquid being pumped, thus enabling it to handle liquid of such consistency as molten sulphur. The sulphur is discharged into storage bins

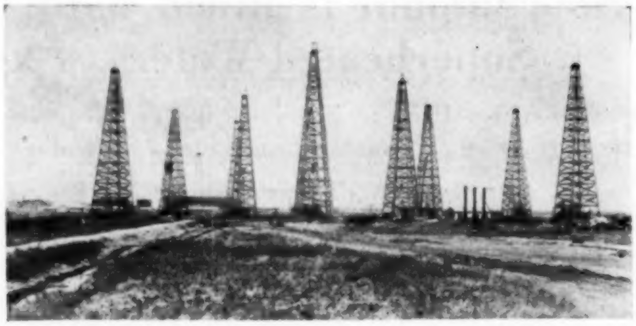


Vertical Centrifugal Pump, Steam Jacketed, for Pumping Sulphur Out of the Relay Stations

2,000 ft. distant, the sides of which are built up with boards as the lake of sulphur rises.

Mining and loading of sulphur out of the bins is the last operation. When the sulphur has hardened, the side boards are stripped off. The pile is drilled, blasted and the sulphur loaded into railroad cars by means of a locomotive crane and hoist grab bucket. A comparison in one of the accompanying illustrations of the size of the railroad equipment with the pile of sulphur formed in the bin will give some idea of the scale of these operations.

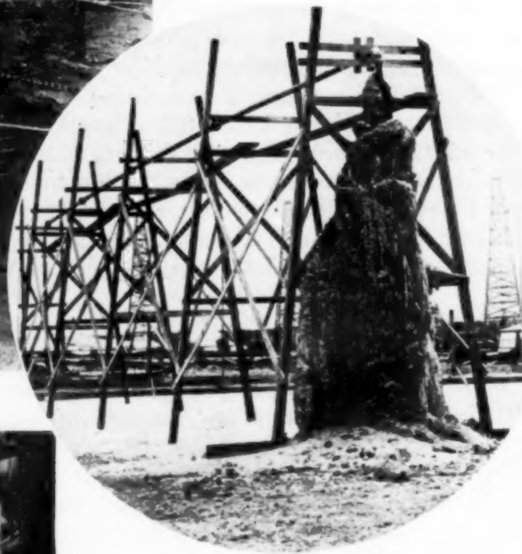
There are many salt domes in Louisiana and Texas

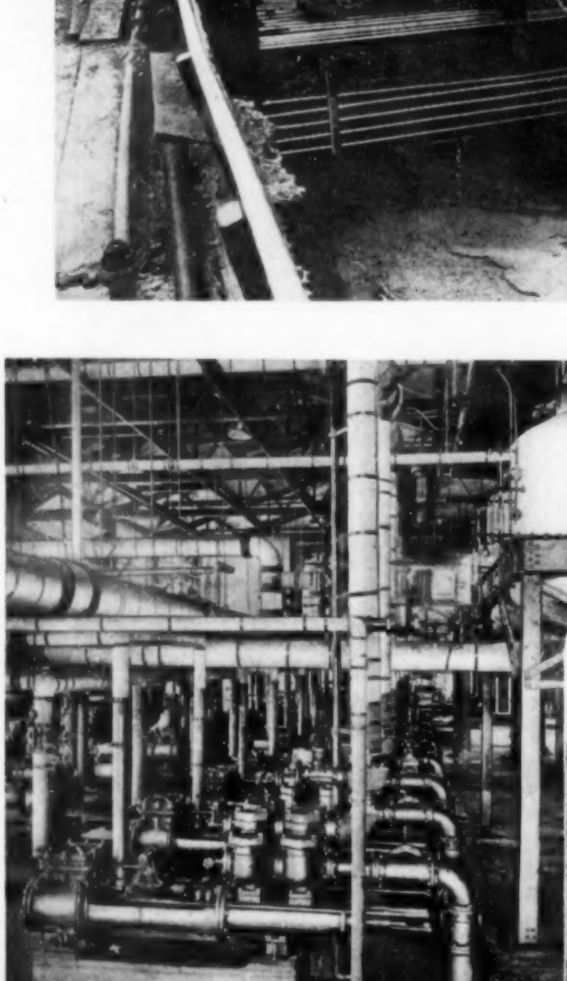


Mining Sulphur at Hoskins Mound

ABOVE—*Sulphur wells are shown in the foreground and, at left, the power plant of the Freeport Sulphur Co.*

AT LEFT—*Melted sulphur being discharged from the wells into one of the relay stations.*

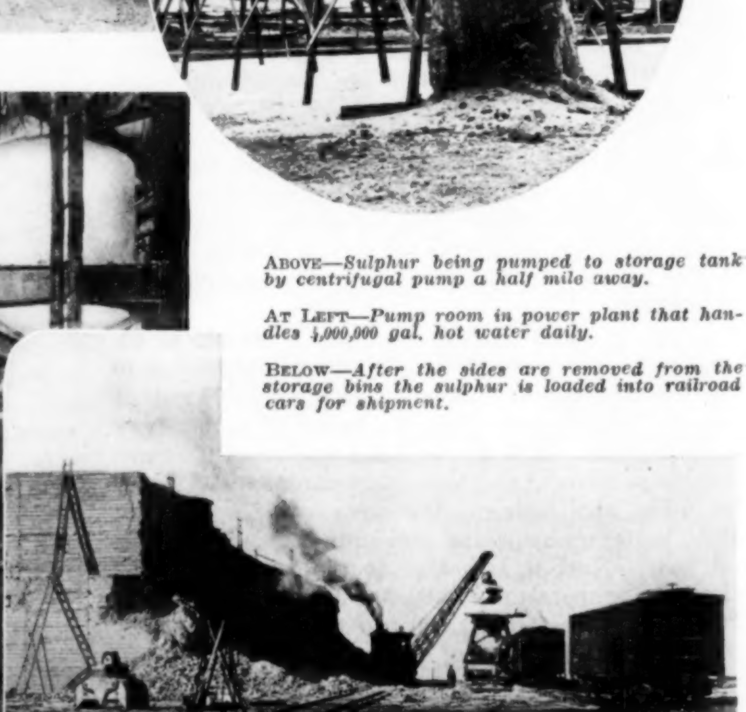




ABOVE—*Sulphur being pumped to storage tank by centrifugal pump a half mile away.*

AT LEFT—*Pump room in power plant that handles 4,000,000 gal. hot water daily.*

BELOW—*After the sides are removed from the storage bins the sulphur is loaded into railroad cars for shipment.*



but so far only five have proved of commercial value as sources of sulphur. They lie along the Gulf of Mexico in a belt 75 miles wide, bounded on the east by the Mississippi and on the west by the Rio Grande. A theory of their formation is that salt of Permian Age was forced upwards in a plastic state and invaded the overlying, newer formations along a general line of major faulting. The domes consist of a salt core overlaid by cap rock of anhydrite, gypsum, dolomite and limestone in which the sulphur occurs. On top of the cap rock occur overlying and abutting sediments manifest at the surface by irregular and more or less circular mounds which may be as much as a mile and a half in diameter. There are many theories as to how the sulphur was formed. One of them is that it was derived from gypsum through action of organic matter by way of calcium and hydrogen sulphides. The sulphur sometimes occurs pure but rarely more than a few feet thick. Its common occurrence is scattered through porous cap rock as seams, cavity fillings, impregnations and disseminations. The sulphur bearing rock varies in thickness from a few feet up to 250 feet, with a sulphur content of a trace to 50 per cent. It has no fixed position in the cap rock and varies widely in the several domes being worked.

Prerequisites for Sulphur Production

After the Hoskins mound was proved to have commercial value, but before work could even begin on plant construction, it was necessary to build 15 miles of railroad over country so low that in the rainy season it is largely submerged. In addition a 10-mile shelled road, to connect with existing highways, 17 miles of telephone lines and 5 miles of water canal were constructed. Following these prerequisites came the main equipment of the property, including a plant of 8,400 boiler horse power capacity, air compressors, turbo-generators, pipe to handle sulphur and water, and pumps in great number to distribute water to as many wells as necessary under varying pressures required by them. The power plant has very high efficiency and is in continuous operation 365 days in the year. Eighty per cent of the heat units in the fuel consumed are actually accounted for in pounds of steam produced. Flue losses and radiation account for the remaining 20 per cent. All exhaust steam from pumps, compressors and generators is used to heat the mine water pre-heaters. Fuel is the largest single item of expense in the production of sulphur with pipe second on the list.

Uses of Sulphur

The uses of sulphur are many and the most important are listed in the order of their decreasing importance:—

1. Acid phosphate (sulphuric acid used).
2. Paper and pulp.
3. Chemicals (other than sulphuric acid).
4. Sulphuric acid (for industries not listed).
5. Agriculture (other than acid in phosphate).
6. Rubber.
7. Explosives.
8. Miscellaneous.

It is very probable that the present deposits in Louisiana and Texas will supply the United States with sulphur, for a great period of years, constituting one of the main bulwarks of defense in times of war and also against the enemies of agriculture, our largest basic industry, in times of peace.

What Does Labor Cost in Terms of Product?

A Comparison of Value of Products with Wages, Salaries and Material Costs in the Chemical Engineering Industries

By C. R. DeLong
Chief, Chemical Division, U. S. Tariff Commission

Editor's Note: With this discussion on labor and material ratios, Mr. DeLong concludes his analysis of the economic relationships existing among such basic factors as value of product, capital invested, wages and salaries and the cost of raw materials. These articles have served to emphasize some fundamental economic characteristics of the chemical engineering industries as a group.

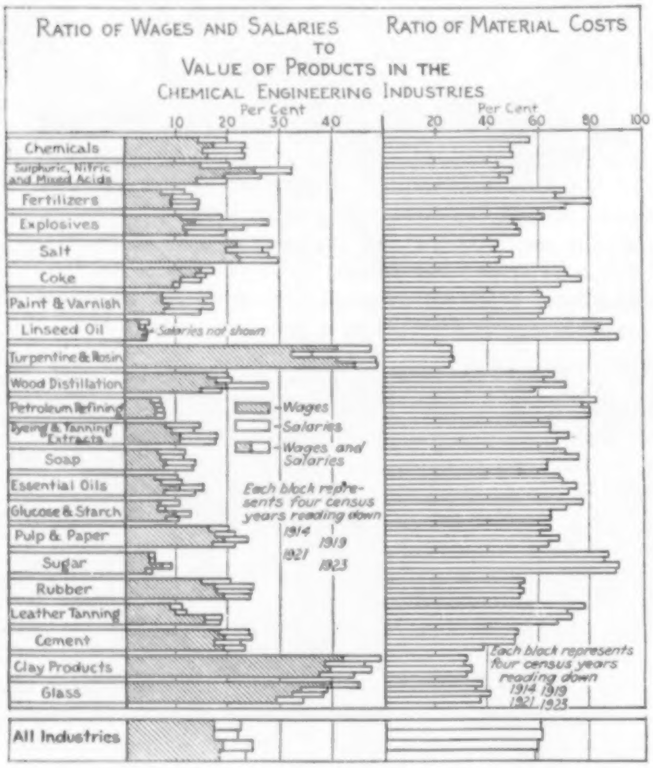
IN ALL INDUSTRY, a comparison of the cost of direct labor with the total value of products indicates the importance of wage cost and furnishes one means of judging the efficiency of production. Figures for all manufacturing industries disclose a wage cost of 17 to 19 per cent of the monetary returns from their products. To this should be added about 5 per cent to cover salaries for general superintendents and administrative expenses, bringing the total expenditure for personal service to 22 to 24 per cent of the value of all products.

There is naturally a wide variation in percentages of incomes disbursed for labor, ranging from a minimum in those industries involving continuous processes, more or less automatic in operation, to a maximum in those requiring a large amount of hand labor. It is interesting to note that the chemical industry is slightly below the average percentage for all industry. The cement, rubber, pulp and paper, and wood-distillation industries approach closely the average wage ratio. The turpentine and rosin industry, however, is conspicuous as the chemical engineering industry which spends the largest proportion in wages, the value of its products depending to an appreciable extent on the amount of labor expended in converting a natural resource to marketable form. The clay-products industry is a like example. The only other consistently above the average is the salt industry.

The industries for which the wage ratio is small include the linseed oil, sugar, petroleum refining, paint and varnish, and the glucose and starch industries. These are, for the most part, industries of continuous process, or which are adaptable to straight-line production methods with a maximum utilization of labor-saving devices. Linseed oil shows the lowest ratio, with a wage cost in 1923 of only 3.3 per cent of the total income from products, and the others mentioned are below 8 per cent.

The glass and coke industries are outstanding examples of reduction in the wage ratio, glass showing a decline from nearly 40 per cent in 1914 to 29 in 1923, and coke from 14.5 to 9.5 per cent. The decline in both industries may be attributed to the use of improved equipment. In the case of glass, the value of products per wage earner was 256 in 1923, as compared with 100 in 1914, and the average wage paid was 188—the result undoubtedly of more efficient use of labor by means of adequate equipment. Comparing these two factors, a similar situation will be noted in the coke

industry. The increasing use of by-product ovens—from 1914 to 1923—effected an increase in value of its products not only through more efficient labor and improved equipment, but by the saving of by-products formerly wasted.



The average annual wage paid in chemical engineering industries in 1923 ranged from a minimum of $450 (turpentine and rosin) to a maximum of $1,696 (coke); the average for all industry was $1,254. Among the strictly chemical industries, fertilizer was low with $881.

In contrast to wages, the proportion for salaries (5 per cent of the value of products) is higher for the chemical industry than for all industry. This is due, it is believed, to the greater amount of technical supervision that is necessary.

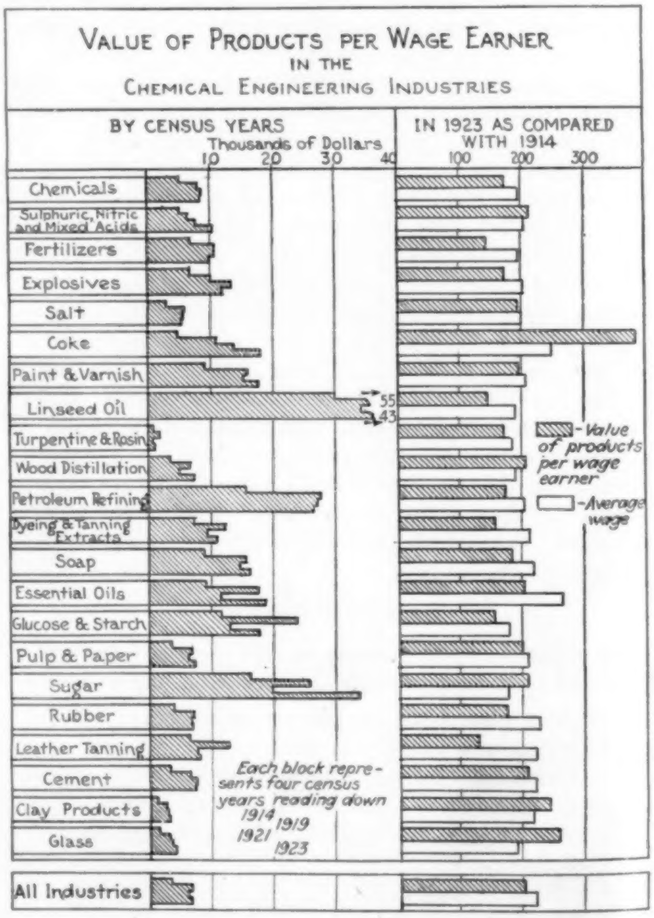
The paint and varnish industry, with a salary ratio slightly greater than the average of all industry, is the only one which expends as much for salaries as for wages. Linseed oil, sugar, and petroleum refining industries show a low ratio for salaries; for linseed oil the salary ratio is less than 1 per cent.

Wages vs. Value of Product per Wage Earner

In Fig. 2 the average annual wage and the value of product per wage earner for 1923 are compared with 1914 as a base (100). The increase in value of products per wage earner should be construed neither as a measure of increased efficiency of the laborer, nor as the result of the increased use of labor-saving devices, without making due allowance for an increase in prices from 1914 to 1923. If the percentage increase in products is greater than the increase in price, the difference may be taken as indicative of an increased output per wage earner, although not an accurate index of the efficiency of labor.

The one true index of more efficient utilization of labor is the quantity of output per wage earner. Unfortunately most of the groupings of industry are so broad that comparisons of all its branches is not possible. A few examples may indicate the trend. The number of barrels of cement produced per wage earner increased from 3,125 in 1914 to 3,910 in 1923, or by 25 per cent. The output of salt per wage earner increased from about 955 tons in 1914 to nearly 1,045 tons in 1923, an increase of about 9.5 per cent. In the case of petroleum refining, the quantity of crude oil refined has increased from 7,550 bbl. per wage earner in 1914 to 9,000 bbl. in 1923, an increase of 19 per cent. Similarly in the coke industry the output per wage earner has increased from 1,600 tons in 1914 to 2,000 tons in 1923. In the case of explosives the production of the individual has mounted from 78,000 lb. in 1914 to over 90,000 lb. in 1923; in the fertilizer industry the increase has been from 375 tons per wage earner in 1914 to well over 400 tons in 1923.

In 16 of the 22 industries the increase in average annual wage from 1914 to 1923 was greater than the increase in value of products per wage earner. The general chemical industry falls within this group. This is supported by the wage ratio for all industry which in 1923 was 217 per cent of 1914, whereas the value of products per wage earner was 200 per cent. In general, then, the increase in wages has exceeded the combined increase in prices and unit output per wage earner. The most notable exception to this generalization is in the case of the coke industry. Here the value



of products per earner (1923—387 per cent of 1914) increased in much greater proportion than the average wage (1923—250 per cent of 1914), in spite of the fact that the increase in wages was greater in this industry than in all others shown, except one.

Both of these may be explained by the marked change

from the old wasteful beehive oven largely used in 1914 to the predominating use of the more efficient by-product ovens in 1923. In 1914 only 27.5 per cent of the output of coke was produced in by-product ovens, whereas in 1923, 67.7 per cent was made in such ovens. This resulted in an increase of 287 per cent in value of products per wage earner, due largely to the additional income from valuable by-products formerly wasted, with only an increase of 35 per cent in the number of wage earners. It will be noted that the average wage in this industry in 1923 ($1,696) is higher than in any other branch whereas in 1914 the average wage of $677 was exceeded by several industries. This change is undoubtedly due to the higher degree of skilled labor required to operate the by-product ovens.

Industries in addition to coke which show a relatively greater increase in value of products than in wages are sulphuric, nitric, and mixed acids; wood distillation; sugar; clay-products; and glass.

Ratio of Materials to Value of Products

The cost of materials is in many industries the most important single item of expense. For all industries it amounts to 57.4 per cent in 1923 of the value of products. The chemical industry is considerably below the average with a material ratio of 50 per cent. On the other hand, the fertilizer industry spends more than the average, or 70 per cent of its receipts for materials. Of the 22 industries shown, 13 have material ratios above the average. Industries having exceptionally low material ratios are turpentine and rosin (26 per cent), clay products (30 per cent) and glass (36 per cent).

A comparison of the wage and material ratios discloses that these ratios are in inverse proportion to each other. Industries having a high material ratio will necessarily have a low wage ratio. Those industries having a high material ratio such as linseed oil, sugar, petroleum refining and fertilizers involve comparatively simple processing of raw materials, such as mixing, refining, or crushing. All of these had correspondingly low wage ratios. Such industries must follow the market closely for their essential materials since one mistake in purchases or contracts for materials may seriously affect profits.

For all industry there has been only a slight variation in the material ratio, which was 57 per cent in 1923 as compared with 59 per cent in 1914. Industries having a lower ratio in 1923 than in 1914 include chemicals, explosives, wood distillation, soap, glucose and starch, leather tanning, and cement. Three industries show substantial decreases from 1921 to 1923: namely, fertilizers from 80 to 70, wood distillation from 70 to 58, and cement from 50 to 38. In contrast to these was the increase during the same period from 82 to 90 in the material ratio for linseed oil.

Wages and Salaries and Costs of Material Compared with Value of Products in the Chemical Engineering Industries, 1914, 1919, 1921, 1923

	Value of Products (Thousands)	No. of Wage Earners	Wages Paid (Thousands)	Salaries (Thousands)	Cost of Materials (Thousands)
Chemicals:					
1914	$158,054	32,311	$22,066	$9,021	$89,451
1919	574,141	71,249	96,250	36,174	280,298
1921	390,768	46,306	58,024	30,870	190,502
1923	630,870	74,897	99,845	39,424	316,901
Sulphuric, nitric and mixed acids:					
1914	15,215	3,064	2,213	870	6,734
1919	31,470	4,961	7,917	2,180	15,857
1921	21,463	2,832	4,137	1,450	9,770
1923	24,405	2,357	3,456	1,394	11,695
Fertilizers:					
1914	153,196	22,815	10,532	7,242	107,955
1919	281,144	26,296	25,363	11,572	185,041
1921	180,375	16,898	16,026	9,820	144,978
1923	183,089	18,572	16,365	9,759	127,980
Explosives:					
1914	41,433	6,306	4,488	3,307	25,627
1919	92,475	9,249	12,505	13,244	45,911
1921	59,175	4,478	6,610	7,000	30,644
1923	75,029	6,388	9,112	5,575	39,496
Salt:					
1914	14,070	5,089	3,041	968	6,273
1919	37,514	6,495	7,353	2,556	16,028
1921	33,159	5,993	7,148	2,025	16,407
1923	36,837	6,809	8,129	2,706	16,477
Coke:					
1914	99,275	21,107	14,289	2,657	69,138
1919	316,516	29,319	42,299	7,606	224,267
1921	221,313	16,070	23,833	8,243	168,791
1923	516,923	28,364	48,108	7,823	354,030
Paint and varnish:					
1914	145,624	16,083	10,180	14,189	88,466
1919	340,347	21,507	24,118	26,523	217,112
1921	274,310	18,015	23,293	23,010	171,398
1923	404,134	22,818	29,871	28,751	248,955
Linseed oil:					
1914	44,882	1,488	1,127	926	39,555
1919	120,638	2,173	3,052	1,409	100,578
1921	71,032	2,073	3,019	....	58,452
1923	113,221	2,631	3,784	864	102,690
Turpentine and rosin:					
1914	20,990	34,817	8,583	1,434	5,536
1919	53,051	28,067	16,972	2,243	13,930
1921	23,301	27,422	9,512	1,820	6,199
1923	35,167	34,328	15,449	1,695	8,973
Wood distillation:					
1914	9,882	2,782	1,565	403	6,496
1919	32,545	4,946	5,310	1,323	20,060
1921	9,258	1,861	1,806	740	6,475
1923	29,297	4,022	4,240	1,217	17,080
Petroleum refining:					
1914	396,361	25,366	19,397	7,892	325,265
1919	1,632,532	58,889	89,750	26,619	1,247,908
1921	1,727,440	63,189	102,294	27,903	1,382,170
1923	1,793,700	66,717	103,834	34,568	1,425,053
All Mfg. Industries:					
1914	24,246,435	7,036,247	4,078,332	1,275,917	14,368,089
1919	62,418,079	9,096,372	10,533,400	2,892,371	37,376,380

	Value of Products (Thousands)	No. of Wage Earners	Wages Paid (Thousands)	Salaries (Thousands)	Cost of Materials (Thousands)
Dyeing and tanning extracts:					
1914	20,620	2,839	1,613	1,389	13,238
1919	53,744	4,342	4,735	2,321	34,593
1921	28,311	2,993	3,008	2,006	20,106
1923	35,972	3,243	3,801	2,427	24,033
Soap:					
1914	127,942	14,172	8,088	6,692	88,867
1919	316,740	20,436	21,228	14,172	238,519
1921	240,195	16,558	18,865	13,701	150,356
1923	276,403	17,002	20,776	15,711	173,546
Essential oils:					
1914	2,314	249	133	105	1,565
1919	5,698	321	391	229	3,903
1921	3,422	299	364	162	2,548
1923	3,184	170	237	188	2,256
Glucose and starch:					
1914	52,615	4,509	3,550	1,940	40,208
1919	186,256	7,795	11,962	2,212	130,329
1921	80,041	6,131	7,840	2,229	50,861
1923	116,560	6,537	9,090	2,838	74,480
Pulp and paper:					
1914	332,147	88,457	53,246	12,918	213,181
1919	788,059	113,759	135,691	29,953	467,483
1921	667,436	105,294	127,029	29,089	445,992
1923	907,347	120,677	151,477	38,086	573,727
Sugar:					
1914	373,639	22,882	15,991	5,252	321,443
1919	937,883	36,084	42,628	11,536	793,317
1921	628,673	31,783	44,418	11,263	565,411
1923	871,736	25,645	31,876	10,751	773,663
Rubber:					
1914	300,994	74,022	44,167	16,279	163,035
1919	1,138,216	158,549	193,763	85,228	594,344
1921	704,903	103,273	123,613	47,255	377,879
1923	958.518	137,868	182,084	48,963	501,163
Leather tanning:					
1914	367,202	55,936	31,914	7,376	284,245
1919	928,592	72,476	88,205	20,179	646,522
1921	383,365	48,955	57,741	13,398	277.725
1923	488,898	59,703	73,784	15,616	321,750
Cement:					
1914	101,756	27,916	18,192	6,065	51,987
1919	175,265	25,524	33,195	9,495	79,510
1921	203,627	26,231	34,416	10,543	102,360
1923	264,098	35,091	49,708	11,232	100,767
Clay-products:					
1914	172,864	126,887	71,574	13,253	154,755
1919	283,342	104,849	108,076	21,844	88,282
1921	278,547	97,217	109,081	22,222	93,503
1923	333,416	102,723	123,773	21,586	103,318
Glass:					
1914	123,085	74,502	48,666	6,549	46,017
1919	261,884	77,520	87,527	13,365	90,780
1921	213,471	54,748	68,224	12,440	86,036
1923	309,353	73,335	89,898	15,519	113,170
All Mfg. Industries:					
1921	43,653,283	6,946,570	8,202,324	2,563,103	25,321,055
1923	60,555,998	8,778,156	11,009,298	3,014,246	34,705,698

Some Applications of Electric Heat In Chemical Industries

In This Final Article of the Series, Some of the Most Important Applications of This Method of Heating Are Described

By Robert M. Keeney
General Engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

THE application of electric heating to industrial work has been most extensive in the following industries: abrasive, automobile, baking, brass, ceramic, chemical, leather, machinery and metal working, paper, rubber, and steel. In most of these industries electric heating has been usually introduced in the last stages of the conversion of the raw material to a marketable product, as for example in the abrasive industry for the manufacture of grinding wheels, in the brass industry for the annealing of small tubing, in the leather industry for the manufacture of shoes, in the motor industry for baking the finish on the car, and in the paper industry for drying the paper.

The manufacture of artificial abrasives depends entirely on the arc furnace or the high temperature resistance furnace for its existence. Without electric heat there would be no abrasive industry as it now exists. After the successful operation of the electric oven for baking japan, it was introduced into the abrasive industry for the drying and preliminary baking of grinding wheels after they were formed. The drying of a grinding wheel before it is finally baked at a high temperature requires a slow uniform baking with a gradually increasing temperature until 500 deg. F. is finally reached after a period of 3 to 5 days. Due to the care of temperature control, electric heating has proven very successful for such operations. The temperature is regulated by a series of knife switch connections, for increasing the kilowatt input of the oven as desired, with the usual automatic control functioning on any of the combinations of heaters used. Several abrasive plants now have an installed capacity of electric ovens exceeding 500 kw.

Baking by Electricity

The electric heating load of the baking and commercial cooking industry is growing gradually and is now estimated at 21,827 kw., of which 4,993 kw. or 22.8 per cent is in the state of Maine, where unusually low power rates exist, considering the small size of the individual oven unit, which rarely exceeds 30 kw. Most of the load in the baking industry is from small ovens requiring from 5 to 30 kw. and from hotel electric ranges. The installations are mainly deck-type ovens in the small bakery or hotel kitchen. A few large bakeries have installed conveyor type ovens, but these installations comprise a very small proportion of the ultimate load possible if electric ovens were used by the large producer of bread.

For the firing of vitreous enamel on sheet steel stove parts or cast iron stove parts, the electric furnace has several advantages and with a power rate of 1 cent per kw.-hr. will probably have as low or lower operating cost than a combustion furnace fired with oil at 6 cents per gallon. Among its advantages are:

(1) Lower maintenance cost.
(2) Greater continuity of operation.
(3) Elimination of oil storage, pumps, and steam plant for heating oil.
(4) Production per sq.ft. in hearth area is 60 per cent higher than in the ordinary oil fired muffle.
(5) Less burned product.
(6) About 7 hours saved in getting the furnace started after a week end shut down.
(7) Cleanliness of furnace chamber.

An electric vitreous enameling furnace 4 ft. wide, 10 ft. long and 13½ in. high with a power input of 163 kw. produces 4.6 lb. of No. 24 gage enameled sheet steel per hour operating at from 160 to 1,700 deg. F. A recent development in electric vitreous enameling furnaces is a continuous conveyor type of furnace. Most of the recent installations of electric vitreous enameling furnaces have been made upon the Pacific Coast where power rates are more favorable to electric furnace operation.

Manufacturing Chemicals by Electric Heat

In the chemical industry little advancement has been made toward the use of electric heat directly in a process except possibly for heating dye kettles. There have been several large installations of electrically heated oil circulating systems, where due to local conditions electric heating was the most economical method. In chemical plants where fats or oils which congeal readily flow through pipes from one piece of equipment to another, electric heating has been an important factor in maintaining a high rate of production. Formerly, it was the custom for the operators to spend several hours each morning with blow torches warming pipes and valves to start the flow of material through the pipes. With the electrically heated system space heaters are permanently clamped to the pipes and valves, and the plant is in operation in a few minutes after the switches are closed.

Electric tube furnaces are being employed for bringing liquids or gases to the desired temperature for chemical reaction. In this case the furnace consists of a rectangular chamber with heating elements on the sides and bottom and a tube or pipe of non-oxidizing alloy passing through the end walls. In one such case a furnace 6 ft. long with a cross section 12 in. wide by 12 in. high, is heated with two high temperature heaters having a total capacity of 10 kw. The heaters are flat in the furnace bottom and heat a 4 in. tube through which a liquid flows continually 24 hours per day to a temperature of 1,200 to 1,400 deg. F. No automatic control is used on the furnace as the flow of liquid is

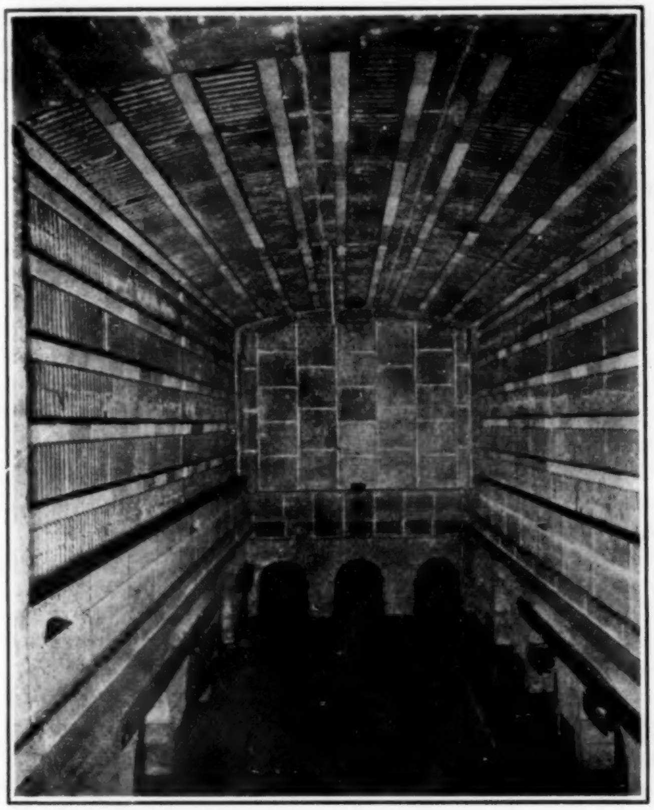


Fig. 1—Interior of 400 Kw. Car Type Annealing Furnace
This view shows the type of coils used and the method of arranging them in car type furnace and tunnel kilns

regulated at the proper rate to maintain the desired temperature. In another plant a tube furnace 18 ft. long, 12 in. wide by 12 in. deep with 42 kw. of heater capacity heats a 4-in. tube through which petroleum vapor is being passed in a cracking process, to any temperature desired up to 1,500 deg. F. This furnace has muffled helical coils in the floor and side walls. There are three sections, each 6 ft. long and each of 14 kw. capacity. The coils in a section can be connected for full load, half load and quarter load by means of knife switches. The installation has proven the means of developing an important method of cracking oil.

Electric heat has recently proven very successful in drying barrels. In the manufacture of barrels and kegs, the flat staves are placed in a barrel assembling machine which bends the staves into the form of the finished barrel. A heavy steel ring is then placed at each end of the staves. Before these rings are removed it is necessary to heat the barrel thoroughly, as otherwise the hoops would break or the staves crack. In many plants it has been customary to heat the barrels around open flame heaters consisting of a stove pipe about 6 ft. in diameter and 2 ft. high with the bottom of the pipe about 6 in. above the floor. Waste wood is burned in this heater. In other cooperage plants coke fired heaters are used. Various methods of handling the barrels are employed.

For heating barrels electrically the space heater is the most convenient and safe heater to use. It is always in stock and does not have two objections inherent in open coil heaters—fire risk due to possible combustion of sawdust on an exposed red hot element and breakage of coils on being struck by a barrel. Electric barrel dryers may be built of space heaters in the manner shown in the accompanying picture, which illustrates part of an installation of 34.5 kw. at the barrel factory of the Spaulding and Frost Co., Fremont, N. H. The space heaters are mounted vertically on a cylindrical shaped frame built up of strap steel and channels, with a base for the barrel to rest upon and a sheet steel cover operated by a foot lever.

Three common sizes of barrels are dried in heaters arranged as shown below.

BARREL HEATERS

Barrel Length Inches	Diam. of Circle on Which Heaters are Mounted, Inches	Number of Heaters	Capacity of Heaters Watts	Length of Heaters Inches	Installed Capacity Kilowatt
12	6	8	220	12	1.76
24	10	8	500	24	4.00
30	17	20	500	24	10.00

Heaters may be designed to operate on 110, 220, 440 or 550 volts but for voltage above 220 should be insulated from ground. No automatic control or three heat control is advisable. Control by a simple knife switch or safety switch is preferable.

PERFORMANCE OF BARREL HEATERS

Barrel Length, Inches	Approximate Time per Barrel—Min.	Number Barrels per Hour	Estimated Watts per Barrel
12	1.5 to 2	30 to 40	50
24	1.5 to 2	30 to 40	140
30	1.5 to 1.75	35 to 40	300

Some of the advantages of electric barrel heating are:

1—Better product.
2—Fewer rejections.
3—Elimination of fire risk.
4—Better working conditions.
5—Operating costs are very little higher, if at all, as power in such plants is generally developed from waste wood.
6—In comparison with heating by super-heated steam the investment in plant is lower.

In the process part of the leather industry there has been little application of electric heating, but in the

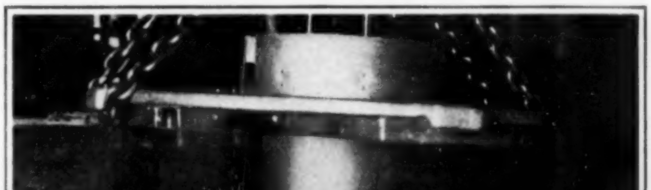


Fig. 2—Electric Lead Hardening Pot Furnace
In this view the pot has been lifted up out of the furnace and the heating elements with their method of attachment are seen

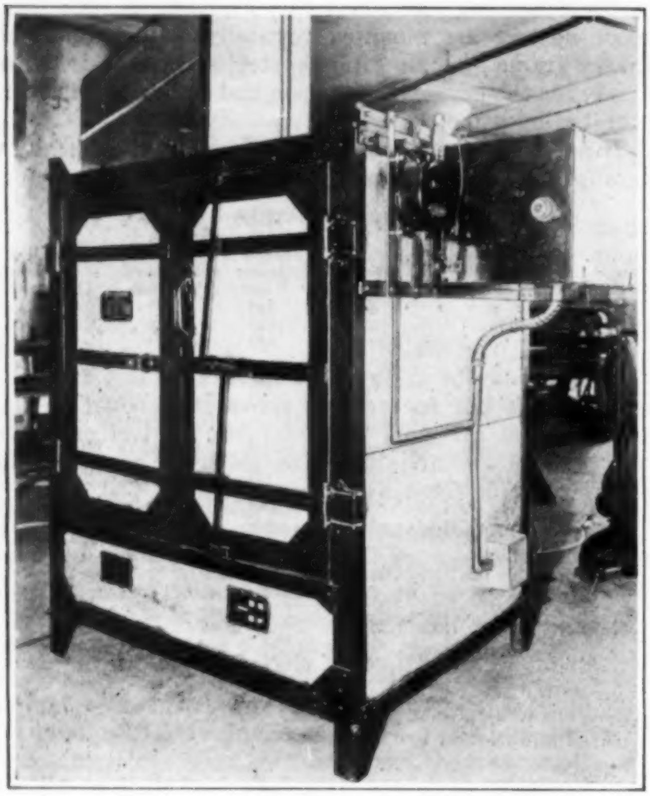


Fig. 3—Shelf Type of Electric Baking Oven
Ovens of this design are made for core baking, but their use in other industries is indicated

manufacture of the principal finished product of the leather industry, shoes, there has been a general use of electricity for heating so that to-day more electrically heated shoe machines are being installed than steam heated machines.

Electric Heat for Drying Paper

Electric heating is entering the paper industry by two methods of application: (1) The electric steam boiler and (2) the electric paper dryer. Electric boilers have been operated in paper mills for about four years. They have been built in sizes up to 25,000 kw. or 2,500 b.hp. for operation on voltages up to 22,000 volts. The boilers operate on three phase, two phase or single phase alternating current. For sizes up to 3,000 kw., the three electrodes of a three-phase boiler are grouped in one tank but for larger sizes each electrode has a tank. Heat is generated by the resistance of the water to passage of the current in accordance with Ohm's law. The boiler is grounded, and is equipped with the usual safety and blow-off valves. The electric boiler has proven economical as a temporary consumer of hydro-electric power during periods of industrial slackness; as a consumer of low cost off peak or surplus power of a hydro-electric central station; as a source of steam in a locality where fuel is expensive and power cheap and where it is advantageous to have the boiler next to the paper machine. The present installed capacity of the Kaelin System is 350,000 kw., most of which is in the paper and pulp industry. The use of electrically generated steam in the paper industry is purely one of economics, as it in no way affects the process.

The most important recent development in the application of electric heating to industry is the Alexander electric paper dryer, developed at Port Edwards, Wis., by J. E. Alexander, assisted by S. A. Staege. As early as 1910 investigations were made of the possibility of electric heating of drying cylinders, but because of mechanical difficulties this method was abandoned and the drying of paper on a webb of wire considered. The first experimental machine was built in 1922, which was followed in July, 1924, by a machine capable of producing 1,000 lb. of paper per hour.

This machine is a 94-in. standard Fourdrinier paper machine designed to run 300 f.p.m. on standard news paper and equipped with an electric dryer. The electric dryer section consists of a 3 compartment brick oven, 36 ft. long, 17 ft. wide and 12 ft. high. The walls are 12 in. thick, consisting of two courses of red brick with 4 in. of mineral wool between them. Inside of the brick work is a steel frame supporting the roof and all working parts of the machine. At each end there is a compartment 4 ft. 6 in. long, with a center compartment 27 ft. long in which all of the electric heaters are located, and where the actual drying is performed. The heaters consist of radiant type coils mounted on insulating brick supported in channel irons. The heaters are fastened to the frame of the oven and operate on 440-volt current with automatic temperature control.

The electric paper dryer operates on a different principle than the steam dryer in that a large volume of air is not used for the removal of moisture, but moisture is removed as superheated steam, a gas. The drying compartment operates at temperature of 450 deg. F. and the end compartments at 250 deg. F. The oven is built as tightly as possible to prevent air leakage. The vapor formed in the center compartment escapes to the end compartments where it is removed by exhaust fans, and in practice can probably be condensed from above 212 deg. F. at least. The power consumption of the Port Edwards dryer is about 0.84 kw.-hr. per pound of paper dried, or approximately 90 per cent efficiency. As a by-product there is available 2.07 lb. of steam per pound of paper dried, or about 2,198 B.t.u.

Some of the advantages of electric drying as outlined by Staege are:

1. Decreased cost of machinery clothing.
2. Decreased maintenance.
3. Reduction in lubrication cost.
4. Practically entire elimination of paper breakage.
5. Better working conditions.
6. No boiler required.
7. Uniformity of drying.

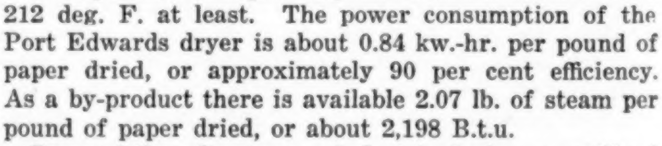


Fig. 4—Battery of Electric Barrel Heaters
Driers of this type are only one of the many useful applications to which the standard forms of electric heating elements can be put

8. Saving in cost of machine furnish because of greater strength of sheet.

Paper dried on the electric machine has greater strength than steam dried paper because every fiber is dried more uniformly and because the drying cycle more closely approaches loft drying.

The installed electric heater capacity in use in the rubber industry is increasing rapidly but the application of the heaters and the results obtained are veiled in secrecy. Immersion heaters have been sold to rubber plants as well as space heaters, cartridge heaters and oven heaters. The heaters are probably being used for vulcanizing and curing because of the possibility of close temperature control.

In the extraction or refining of sugar there have been no unusual applications of electric heating in the process, but the electric furnace helps keep the wheels turning in one sugar plant. A pit type furnace 20 ft. long, 3 ft. wide, and 3 ft. deep with automatic control is used for annealing sugar mill roll shafts in order to relieve strains after years of heavy service. These shafts are 18 in. in diameter and 15 ft. long. For any industry so far removed from high temperature furnace operation as the sugar mill, the electric furnace is ideal for heat treating work, because there are so few variables to be guarded against by the superintendent familiar with the details of the sugar process but with only a general knowledge of heat treating.

Summary of Electric Heating

At the present rate of growth the total industrial electric heating load of the United States will exceed the total electric furnace melting load within a few years, as its growth is proceeding much more rapidly than that of the melting load at the present time. The installed industrial heating load of this country is estimated at about 133,000 kw., as compared with an electric furnace melting load, of about 171,000 kw. The power used in manufacture of ferro-alloys, aluminum, carbide and abrasives is not included in these figures. It is to be noted that the load factor of the heating load is estimated at 21.2 per cent as compared with a load factor for the melting load of 26.9 per cent. Of the four industrial heating sub-divisions, furnaces, ovens, baking and unit heating installations, heat treating furnaces have the highest load factor 29.5 per cent. Brass melting furnaces have a considerably higher load factor than steel melting furnaces, 34.7 per cent as compared with 25.3 per cent. This is due to the electric furnaces installed in brass rolling mills which operate 24 hours per day. In Connecticut, where brass melting furnaces are practically all in rolling mill service, the estimated load factor for an installed capacity of 6,200 kw. is 75.3 per cent.

Penetration of electric heating has probably been greatest in the automobile industry and the shoe industry with the machinery and metal working industries next in importance. Of the basic industries which work with raw materials, the electric steam boiler, the total installed load of which is not included in the figures given probably puts the pulp and paper industry in the lead, followed by the baking, brass, abrasive, rubber, ceramic, steel, chemical, and sugar industries. The glass industry offers a promising field for investigation.

ESTIMATED ELECTRIC HEATING LOAD OF THE UNITED STATES

	Installed K lowatts	Annual Kwh. Consumption	Total Power Cost	Load Factor, Per Cent	Power Cost per Kwh., Cents
Industrial Heating					
Ovens	61,639	118,272,503	$1,997,002	21.9	1.60
Unit heating	27,127	48,077,188	1,211,205	20.2	2.51
Furnaces	22,676	58,596,502	989,091	29.5	1.68
Baking	21,827	21,780,172	522,592	11.3	2.39
Summary	133,268	246,726,365	4,719,890	21.2	1.91
Melting					
Steel	142,675	317,316,430	3,864,735	25.3	1.21
Brass	29,047	88,525,354	1,415,516	34.7	1.59
Summary	171,722	405,841,784	5,280,251	26.9	1.30

Low Temperature Carbonization as a Commercial Process

A Discussion of the Probable Market for the Smokeless Fuel, High-Heat Value Gas and Tar Oils Produced

By William Hutton Blauvelt
Consulting Engineer, New York, N. Y.

While different processes for carbonizing coal employ temperatures all the way from the lowest at which the volatile matter can be distilled up to the highest that the best refractories can withstand, it has been generally agreed that true low temperature carbonization is limited to temperatures at which the volatile matter is driven from the coal without effecting a secondary reaction on the primary products of the distillation. No definite line of demarcation can be established, setting off the low temperature work from the high on account of the very complicated products evolved from coal when it is treated. Ethane, propane and the higher members of the paraffin series are evolved as gases at temperatures below 450 deg. C. and these bodies probably suffer some degradation at the working temperatures employed.

Products of American Coals

But the investigations of a number of students of the composition of coal confirm the conclusion that practically all coals have a decomposition point that is well defined, usually between 700 and 800 deg. C., and bodies of the paraffine series are practically all evolved when the coal has reached these temperatures. As the secondary reactions begin at 700 deg. C., it seems logical to adopt these figures as representing the upper limits of true low temperature distillation.

The temperatures finally adopted in most processes of low temperature distillation will probably be materially influenced by the effect of these temperatures upon the quality of the oils produced and the demand in commercial markets for oils of certain composition. Considerable study has been given by investigators to the composition of these low temperature oil products and we have many analyses of oils from laboratory operations, but in this country no process has been definitely established on a commercial basis, no supply of oil has been available to commercial users, consequently there has been no exhaustive investigation of these oils from the point of view of their application and value in the commercial markets. We do not know as yet even approximately what total yield of oil can be expected from the low temperature distillation of representative American coals. Several processes operating on a semi-commercial scale appear to have recovered quantities from 30 to 40 gallons per short ton of coal. Careful work by the United States Bureau of

Mines shows that from standard Pittsburgh coal yields amounting to 32.5 gallons dehydrated oil and 3.2 gallons light oil may be expected. Very high yields are sometimes reported owing to failure to fully remove all water from the oil.

As to the composition of these oils it appears safe to say that they are largely of the paraffine series, but as stated above their composition is affected by the temperatures to which the coal and oil are submitted in the carbonization process. Simple fractionation yields an average of about 15 per cent of low boiling oils available for motor fuel. The tar acid content is high as compared with coal tar, but these acids are mainly the cresols with very little phenol. It may be that the fraction corresponding to the commercial creosote oil of the tar distiller will prove of important value for creosoting purposes, but it does not correspond with the present specifications and its value in the creosoting field must be worked out by research and in commercial practice. The cresol fraction will undoubtedly have value as a disinfectant.

In other words, these low temperature oils have still to find and develop a market in order that their best value may be realized. It is probable that the low boiling fraction can quickly be made available as motor fuel, leaving for the remaining fractions only the low priced fuel oil market, until investigation and experiment have demonstrated their real worth and proper place. Claims for high values of these oils have been made by promoters of several of the low temperature processes, some claiming as much as $0.50 per gallon, but until the full value of these oils has been determined by research and experience in commercial application the returns from any prospective installation should be estimated on prices for the oil based on present conditions as indicated above.

Market for Gas

The yield of gas from true low temperature distillation is of course much lower than from high temperature operation. Probably an average figure from representative coals would be about 3,500 ft. per ton and the calorific value is generally very much higher than that made in high temperature processes. There has frequently been found a wide difference between the calorific value of the gas as determined in the laboratory and under the same process in works operation. J. D. Davis in his work for the Bureau of Mines obtained yields from Pittsburgh coal from 3,400 to 7,175 ft. per ton depending on the temperature used, and of about 680 B.t.u. per foot.

The actual calorific value and composition of the gas depend largely upon the opportunity offered by the process employed for the exclusion of air and the protection of the gas from cracking by contact with highly heated surfaces. The most efficient utilization of this gas of relatively very high heat value has not yet been worked out. In some processes it is employed for heating the retorts, but this would seem to be uneconomical as a general proposition, provided there is a market wherein its special value can be realized. Of course the growing tendency to employ gas of lower calorific value for domestic use is not favorable to the realization of the full value of this rich gas except in special cases where it may be used for improving the quality of another gas which is below the commercial standard.

The yield of ammonia is small in all low temperature operations. Most investigators find only from seven to ten pounds of sulphate of ammonia per ton of coal, too little to justify the expense of recovery.

A recent writer has set down the following four important factors which determine the commercial success of a plant for the low temperature carbonization of coal:

1. There must be ample supplies of the raw material.
2. The plant must be well built to insure efficient and continued operation and it must have an experienced and capable staff.
3. The solid and liquid products must be in marketable form either for direct use by the consumers or as raw material in other industries.
4. The commercial value of the products must admit reasonable profit over working costs and manufacturing expense including maintenance and depreciation.

Unfortunately much of the work that has been done by inventors of the various low temperature processes has not been based on scientific and technical knowledge or a recognition of the limitations of the materials used in the construction of the plants or of the nature of the products to be recovered.

Low Temperature Coke Needed

The great amount of effort that has been expended by many inventors in developing their processes for the low temperature distillation of coal suggests that the economic demand has arrived for a process to improve the form value of bituminous coal which can be economically operated in small working units of relatively low first cost per unit of product and which is simple in operation. The public is demanding more than ever before a smokeless domestic fuel which is easy of ignition and which can be produced at a cost not greatly above that of bituminous coal. One-sixth of the coal produced in the United States is burned in our homes. It is now generally recognized that the smoke nuisance in our cities is largely the result of domestic fires. The relatively high percentage of volatile matter in low temperature fuel makes it easy to ignite and a good fire is easily maintained as compared with coke. As compared with bituminous coal it is of course free of smoke, somewhat easier to ignite and it has distinctly more radiant heat, estimated at about 20 per cent.

The area over which anthracite can be distributed at anything approaching a reasonable cost is becoming more restricted and there is little prospect of any lower prices. Coke is meeting considerable success as a domestic fuel, but its manufacture must ordinarily be concentrated in plants of considerable size requiring the expenditure of large capital, and the domestic coke now on the market is in most cases produced incidentally to a much larger production of metallurgical coke in the same plant.

Field for Process

As we study the domestic fuel situation in this country it appears that a well worked out and economical method of low temperature distillation of coal should have a wide field as soon as plants of relatively small capacity can be economically installed and operated so that they are available for supplying a desirable smokeless fuel in small localities. Moreover, they should be simple to operate as they have not the diversity of byproducts such as are obtained from a by-product coke oven plant. It would appear that a simple treatment of the oil, which is practically the only by-product, will make it available in many local markets.

An ideal domestic fuel must ignite readily, must

have a high degree of combustibility and must yield a good portion of its energy as radiant heat. Ease of ignition is obtained by the retention of more volatile matter than is usually found in standard coke. A high combustibility insures the maintenance of a rate of combustion which will preheat the successive layers of fuel up to the ignition point as the outside layers are burned away. This secures a fire easy to maintain, which is an important factor in a satisfactory domestic fuel.

Combustibility is largely a matter of cell structure, that is, the size and arrangement of the cells and the composition of their walls. Charcoal has the highest rate of combustion of commercial fuels, its cells run from end to end of the piece and the walls are of a nature to be easily attacked by the oxygen in the air. In ordinary high temperature coking the resins of the coal melt below the temperature of decomposition forming a viscid mass. As the temperature increases gas is evolved producing in the viscid mass a series of bubbles. As these gases escape they run into one another and the cellular structure of representative coke is produced. As the temperature of metallurgical coke reaches its finishing point the lighter gases still left in the cell walls are forced outward having to penetrate through the hot mass of coke and in their passage the hydrocarbons are decomposed, depositing carbon on the cell walls. The relatively low combustibility of high temperature coke is probably due to the action described above. The mere presence of a larger percentage of volatile matter probably does not increase the combustibility of the coke although it may tend to help its inflammability.

Of course in the low temperature process the cell walls produced by the escape of the gases during the viscid stage are not subject to the deposition of carbon because the temperatures used in the process never reach the point where the last hydrocarbon gases are decomposed. The result is a higher percentage of volatile matter and a softer, more spongy cell wall much more susceptible to the action of oxygen.

Domestic Market for Coke

Domestic coke from high temperature plants has met with great and growing success in our markets and this success is deserved on several accounts. From the above analysis it would appear that low temperature coke may also find its field of usefulness as domestic fuel provided the process employed produces a fuel that has the necessary toughness to prevent degradation by attrition and a physical appearance that will satisfy the eye of the customer.

In the development of a low temperature process with a view to the domestic market the operator must recognize the necessity of a fuel which will bear handling with but a small amount of degradation. He must therefore adapt his process to one of the following:

1. Obtain a carbonized product of sufficient toughness to resist attrition and having pieces of a size to which the domestic consumer is accustomed.
2. Or briquet the carbonized product.

Briquetting usually entails a third process namely, the baking of the briquet to insure smokelessness. Of course this adds to the operating cost an amount which might in some cases be prohibitive.

The greater possibilities of low temperature distillation of coal in the field of domestic fuel are to be found, I believe, mainly in localities where the public is accustomed to the use of bituminous coal and is ready to adopt a smokeless and superior substitute. I can conceive therefore that the price of this substitute fuel should usually be nearer the price of bituminous than that of anthracite. According to this view the successful process will be one of few complications with apparatus that lends itself readily to economical operation.

New Process for Cooking Strawboard Would Simplify Stream Pollution Problem

Research of Forest Products Laboratory Shows that Substitution of Soda for Lime in Straw Cook is Commercially Feasible

A method for reducing the contamination of streams by strawboard mills was discussed by John D. Rue and Francis G. Rawling of the Forest Products Laboratory at the Kalamazoo, Mich., meeting of the Technical Association of the Pulp and Paper Industry, in two detailed reports.

In the lime process of cooking straw it has been found impracticable to dispose of the waste except in natural streams or by impounding it in settling basins. Attempts have been made to separate the solids by mechanical filtering or settling devices and to dispose of them with the aid of bacteria, but all of these practices except the first have been followed to only a minor extent and are possessed of limitations that render their extension undesirable and impracticable. Most of the waste now finds its way into streams. It consists for the most part of matter, chiefly organic, removed from the straw, but in addition it contains excess lime, insoluble lime salts, and fiber. The obvious method of eliminating the whole source of contamination is to evaporate the water and burn the residue, recovering the fuel in the residue. In the way of this solution of the problem, however, there stand several obstacles, the most serious being that the amount of water necessarily associated with lime wastes is so large that economical evaporation is out of the question.

The new process, which was devised by John D. Rue and William H. Monsson of the Forest Products Laboratory, should obviate many of the difficulties of recovery and waste disposal inherent in the lime process. Briefly, it is as follows: The straw is prepared and charged in ordinary rotary digesters. Instead of lime the liquor contains to each 100 lb. of dry straw 7½ lb. of soda ash and 1½ lb. of sodium sulphite. Other proportions may be used, but this has been found effective. Temperature and pressure will be governed by the limitations of the equipment. Cooking for 10 hr. at 40 lb. gage has on a commercial scale resulted in a pulp superior in strength to the lime-cooked product. The method of handling the straw from the digester to the finished board is the same as that followed in the older process.

Calculations show that it should be economically feasible to evaporate the waste liquor from the process, burn the residue, and recover the soda with at least 67 per cent chemical efficiency. Thus practically complete removal of the pollution nuisance would be effected in addition to the recovery of chemicals used in the new process for cooking the straw.

Economical Use of Sulphite Liquor

Successful Application of New Evaporator Marks Distinct Advance in Technology of Paper Manufacture

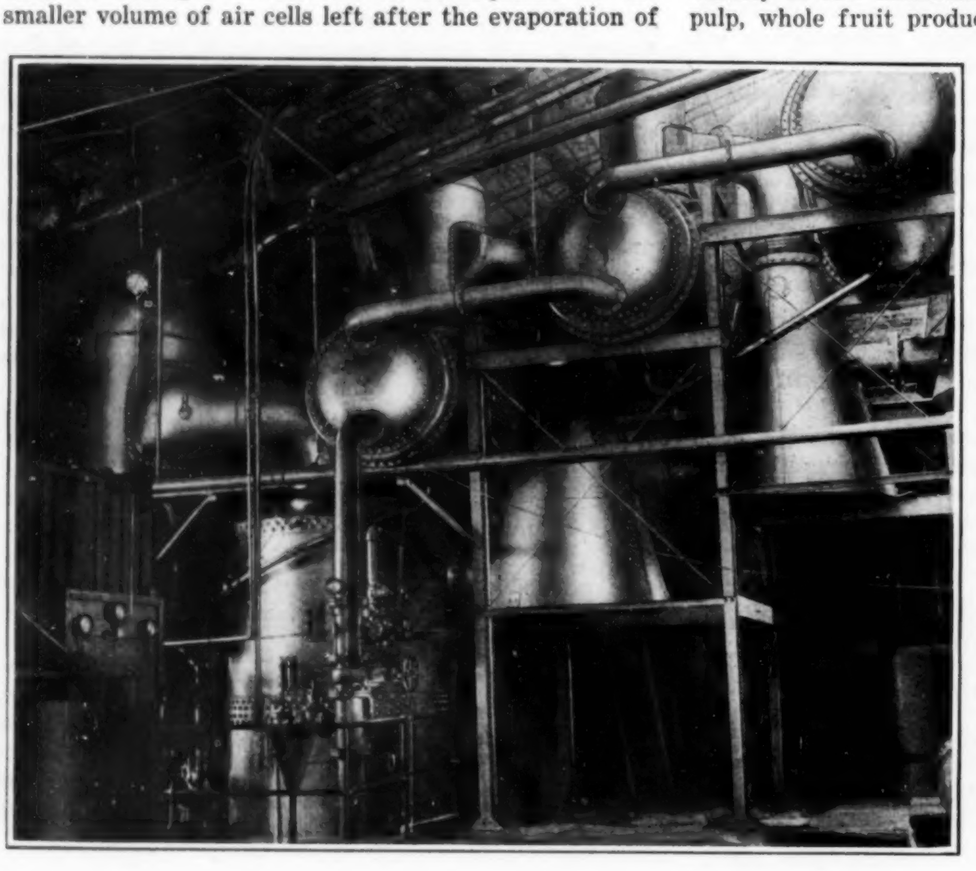
By A. W. Allen
Assistant Editor, *Chem. & Met.*

What is perhaps the most colossal waste in industrial effort occurs in connection with the sulphite pulp process, almost all the effluent from which, rich in lignin and chemicals, is sent to the sewer. The problem was primarily one of correct evaporator design and operation. This article describes a new type of apparatus that is giving satisfactory results. This development marks a major step in the solution of what has hitherto been one of the outstanding problems in the chemical engineering industries.

SULPHITE LIQUOR is a substance of diversified properties and increasing industrial applications. It contains more than 50 per cent of the original weight of the wood used, and therefore has a definite fuel value. It has been utilized as a binder, in tanning operations and as a base for the manufacturer of alcohol. Recent research has drawn attention to its highly adhesive properties, to its possible value as a lubricant, as a stabilizer of suspensions, foams and emulsions, and as a medium for the promotion of wetting surfaces that normally resist contact with a liquid. It has been proposed as a fluid vehicle in ceramic work, whereby less water is needed to secure plasticity, and greater ultimate strength is secured in consequence of the smaller volume of air cells left after the evaporation of contained water. More recently, attention has been drawn to its value as a substitute for glue in the refining, using acid electrolytes, of tin, copper and lead. By the use of concentrated sulphite liquor it is claimed that considerable economies can be effected; the electrolytic solution resulting is clear, and a superior cathode deposit is obtained.

One of the main difficulties in the utilization of the valuable ingredients of sulphite liquor is its dilution, a condition that is aggravated by the unscientific methods generally adopted for the washing of the cooked fiber and the displacement of the solution associated with it. When this phase of processing is modified more in line with recognized technical principles and logical methods, the problem resulting is mainly one of economical evaporation. Preliminary neutralization has been assumed to be necessary, but this step can be avoided, as will be demonstrated later in this article. The incrustation of heater tubes has been the cause of fluctuating efficiency and low average heat transfer in the evaporation of sulphite liquor, as well as in many other applications of the vacuum pan in evaporator work. This has been due primarily to low solution velocity and local overheating. The successful use of the Peebles evaporator in the concentration of a wide variety of raw materials—milk, tannin extract, tomato pulp, whole fruit products and, finally, sulphite liquor—has demonstrated that the adoption of the fundamental principle recognized by the inventor—high solution pressure and rapid flow through heaters that form units separate from the evaporation chambers—is likely to find wide application.

The new quadruple-effect evaporator plant to be described, now in successful operation at a sulphite pulp plant in the Sierra Nevada, was designed by D. D. Peebles, of Eureka, Calif. It is characterized by evidence of unusual attention to detail. The general arrangement is shown in Fig. 1. The unit is being operated on the batch system, the raw liquor entering,



This general view of the evaporator plant shows three of the four heaters, expansion chambers and entrainment traps. The condenser is beneath the largest entrainment trap, to the left.

and mixing with the circulating liquor in a large expansion chamber (fourth effect), which drains to a 10-in. Cameron centrifugal pump. The delivery from this goes through heaters Nos. 4, 3, 2 and 1, in series, passing from the last mentioned heater into the first effect expansion chamber, thence to the second- and third-effect chambers, and back to the fourth.

Heater No. 1 is supplied with fresh and exhaust steam, the condensate from which goes back to the boilers. The vapor from the first-effect chamber passes to an entrainment trap (draining back into the chamber), thence around the tubes in heater No. 2; the condensate passes to heater No. 3 which, in turn, takes the vapor from the second-effect chamber, connecting in similar fashion to a drained entrainment trap. The vapor from the fourth effect passes into the largest of the entrainment traps, which is placed above a cold water condenser, and connected in turn with two Radojets, for the removal of non-condensed vapors. These units, made by the Wheeler Manufacturing Co. of Philadelphia, are of the two-stage type, of non-corrodable metal, each capable of removing 25 lb. vapor per hour at 70 deg. C., and maintaining a vacuum of $1\frac{1}{2}$ in., absolute. The steam consumption totals 1,000 lb. per hour for the two pumps. The potential energy is converted into high velocity energy by expansion, a steam jet entraining the vapor. The mixture is then delivered at high velocity into a diffuser, where the high velocity energy is reconverted into pressure energy, and the pressure of the vapor correspondingly raised. The operation of this apparatus will be appreciated by reference to the accompanying line drawing (Fig. 5) illustrating a pump cut through a vertical center line.

Live steam enters at *L*, passes through vertical piping to an auxiliary valve, through a strainer cage and through expansion nozzles that deliver across a chamber connected with the condenser. Entrainment of vapors occurs, the mixture passing into a diffuser, from which it is discharged, at high absolute pressure, into a double chamber connecting with the second-stage suction chambers. Concurrently, steam is also delivered and escapes into this chamber through annular nozzles. The vapor and steam from the first stage is thereby carried into a diffuser, where it is compressed to atmospheric pressure, to be delivered into a casing connected with the discharge.

The constructional features of the evaporation plant, which was fabricated at the E. M. O'Donnell Copper Works, San Francisco, are of interest. The heaters and evaporation chambers are lined with $2\frac{1}{2}$-in. acid-resisting tile, with phosphor-bronze sleeve connections and fittings. The fourth-effect chamber, which consists essentially of a cylinder, 7 ft. in diameter and 14 ft. 6 in. high, is provided with three 2x10-in. sight glasses on the side and two $3\frac{1}{2}$-in. diameter sight glasses on the top.

The first-, second- and third-effect chambers are in

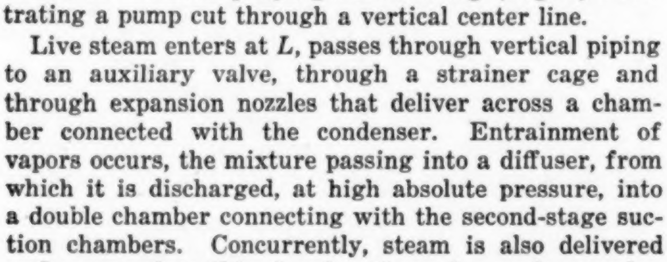


Fig. 2—Details of Baffle Valve Between Expansion Chambers

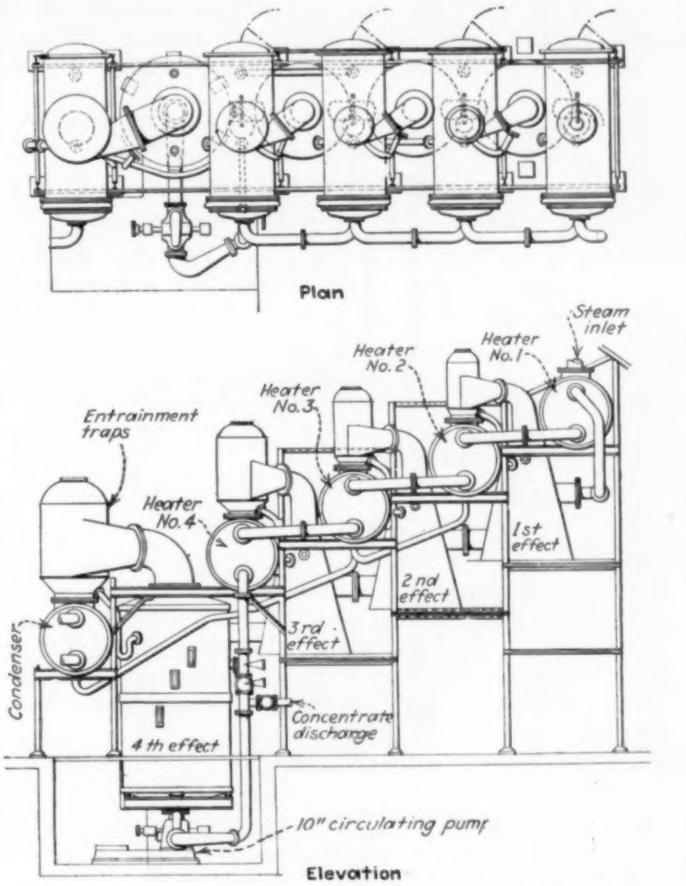


Fig. 1—General Arrangement of Peebles Quadruple-Effect Evaporator

the form of circular cones, arranged with bottoms sloping toward the exit, and are all of the same dimensions. Each is provided with two $3\frac{1}{2}$-in. diameter sight glasses. Into each drains the liquor from the entrainment trap that takes the vapor from that chamber. A special baffle valve, of bronze, has been designed for the purpose of regulating the flow of liquor from one evaporation chamber to the next, and thereby maintaining the correct level in each. This consists (see details, Fig. 2) of a depressed disk with cross webs, the exterior dimension of the smaller part of which is $\frac{1}{8}$ in. less in diameter than the bronze collar that lines the pipe connecting the chambers, in which it is therefore free to move in a horizontal direction. The liquor passes between three out of four of the spaces between the webs—the top quarter being blanked—impinges against the depressed disk and is scattered downwards and sideways. Adjustment of flow is made by means of two bolts with appropriate stuffing boxes, which pass through the shell of the chamber, the heads of which hold at the correct distance the lugs of the baffle valve.

The cold water condenser is a duplicate of the four heaters, all being lined with acid-resisting tile and provided with bronze heads. The copper tubes in each, of an internal diameter of 1 in., are 8 ft. long. A characteristic feature of operation is the absence of evaporation while the liquor is in contact with the heating surfaces. A constructional detail of interest is the provision of a special type of copper expansion joint (Fig. 3), which can be renewed without removal of the tubes from the shell. The entrainment traps and connecting piping are of copper, all the interior surfaces having been given a lead wash. Recording instruments

are to be used for the control and registration of vacuum and temperature, and a steel grating and stairway is to be erected to facilitate inspection. Typical

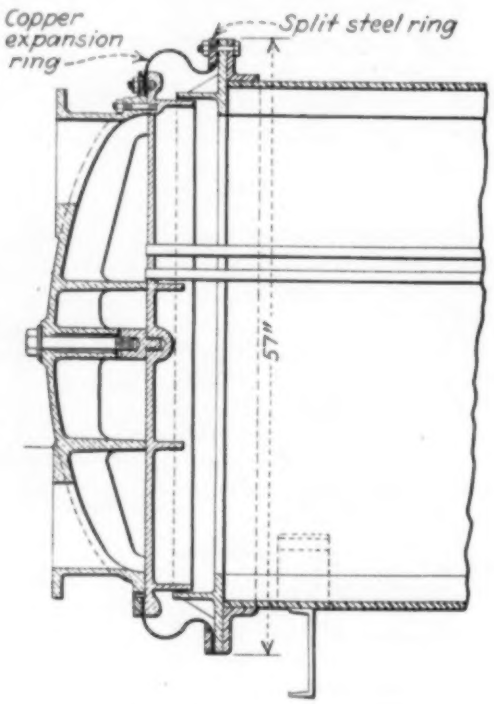


Fig. 3—Details of Copper Expansion Ring in Heaters and Condenser

vacuum readings on the gages above the entrainment traps are, respectively, (1) 23½ in.; (2) 20 in.; (3) 17 in.; (4) 5 in. Circulating pump pressure is maintained at about 25 lb.

Burning the Concentrated Liquor

Sulphite-liquor solids have a fuel value of about 8,000 B.t.u. per pound, but the burning of the concentrated liquor was more or less of an experiment. During the time of my visit to the plant, late in September, the boilers were fired each with three fuel-oil atomizers and two sulphite-liquor atomizers. At first some mechanical trouble resulted when an attempt was made to carry concentration to a high degree. The circulating pump proved to be inadequately powered for the higher load, and a few instances of nozzle chokage and minor explosions occurred at the boilers. With a solution of 55 per cent solids or thereabouts, however, operation was smooth.

Improvement in the efficiency of boiler operation was sought, however, and Mr. Peebles decided to try displacing part of the water in the concentrated liquor with fuel oil. In an experiment, eight barrels of this was taken into the system during the evaporation of a batch, the result being a uniform emulsion that gave complete satisfaction. To minimize condensate contamination, the oil is now added during the final stages of concentration. This innovation permits the evaporation of more water from the liquor, without decrease in the fluidity of the fuel resulting, which has a lower kindling point than the straight sulphite liquor.

Final adjustments will insure steady operation of the plant throughout the twenty-four hours and the more efficient utilization of waste heat. Largely because of freedom from interruption, the capacity of the unit is more than sufficient for present purposes; and all the liquor from the digesters—60,000 gal. or so per 24 hr.—can be evaporated in two batches of 6 to 8 hr. apiece. Original solid content of the liquor averages 4 to 5 per cent; final solids, 55 to 60 per cent. The exhaust steam used, which comes from a uniflow engine operated at 10 lb. back pressure, constitutes what is available from this source after the paper machines have absorbed what is needed for drying. Recent reports show a decrease in the consumption of fuel oil used to operate the entire plant, thereby indicating that the evaporator is an economical addition to the equipment. From present indications it would seem that a mixture of 640 gal. fuel oil and 3,000 gal. concentrated liquor forms a desirable liquid fuel for the boilers. It is planned to effect further heat economies in the plant by the installation of a fifth heater, through which will pass the relief gases and liquors from the digesters. The ash from the boilers has an alkaline reaction. It consists of minute, exploded globules, with a bulk specific gravity of 0.13. The utilization of this is a minor research problem now receiving consideration.

Disposition of Acid Condensate

The condensate from the evaporator has a distinctly acid reaction, which prohibits its use for many purposes that would otherwise be suggested. Neutralization by means of leaching through a bed of ash from the boilers was considered; but its utilization in the acid plant was obviously more logical. However, an objection to this proposal was seen in the fact that the quantity of condensate produced was far beyond requirements. It is probable that the problem will be solved in the following manner: The major amount of acid-forming gas is released in the early stages of concentration of the liquor, but contamination of the condensate continues so long as fresh liquor is being added. A storage tank will be provided, connected with the expansion chamber above the pump. A valve in this line will be cracked

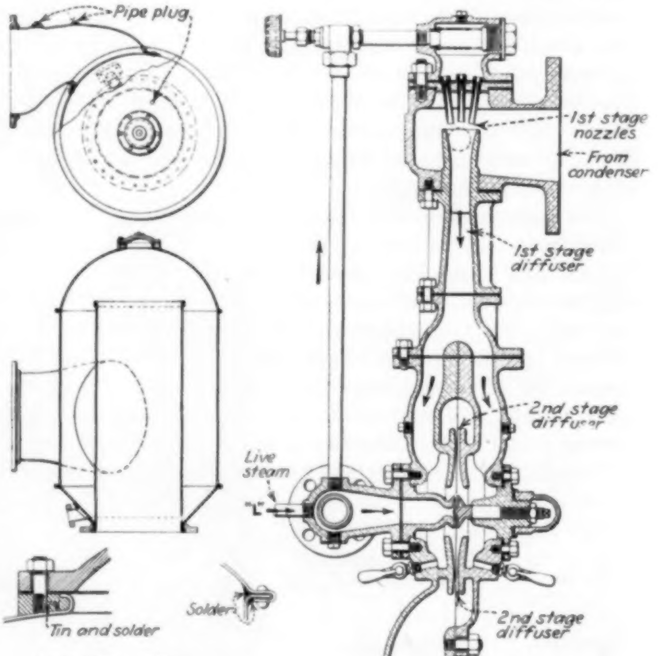
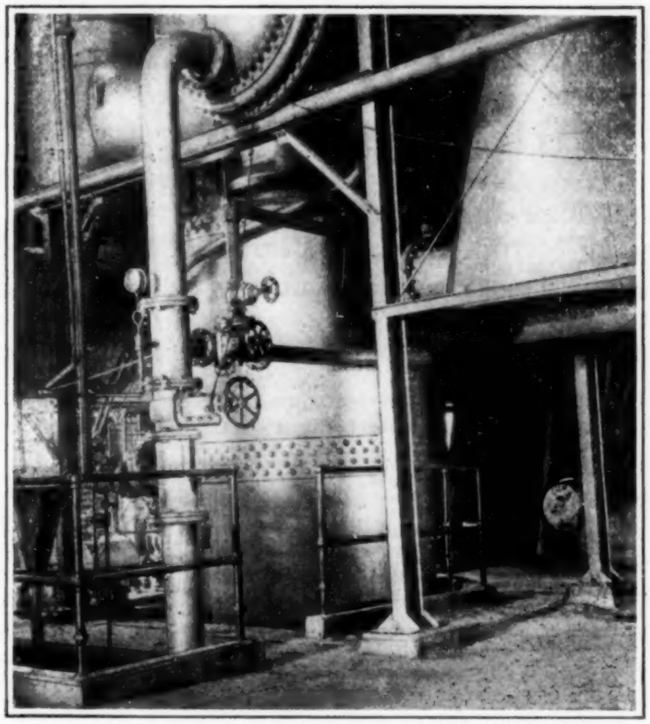


Fig. 5—Cross-Section of the Pump Used for the Removal of Vapor

Fig. 4—Design and Construction Details of Entrainment Traps



Fourth-Effect Chamber, with Piping (Large) from Pump in Sump, to Heater; and Fresh Liquor Supply Piping (Small) to Chamber

at a certain stage of concentration, so that a small flow of partly concentrated liquor is sent to temporary storage. While fresh liquor, needed to make a batch of concentrate, is being added to the unit, the condensate will be fairly strongly acid. This is to be cooled and sent to the acid plant. Thereafter, the semi-concentrated liquor in the storage vat will be fed back into the system, the amount of acid in the condensate resulting being insufficient to cause trouble.

No accident or set-back of moment that would indicate a failure to anticipate the result of effect from cause in the solution of so complicated a problem—mechanical as well as chemical—has occurred. Five copper tubes in the condenser broke away cleanly from the head, for some unexplained cause. As the temperature range is small in this unit, it is possible that vibration, from the circulating pump, was responsible. Frequent examination of the tubes in the heaters shows no corrosion and very little accretion after several weeks of operation, which is eloquent testimony in favor of the soundness of the high-velocity principle recognized as a fundamental in evaporator practice. A slight accretion is found to occur at the ends of the tubes, which is probably due to sluggish movement caused by eddying; but, as these ends do not contact with heating surfaces, no trouble results. It seems probable, therefore, that tube cleaning will be a perfunctory operation, involving a negligible loss of time.

German Source of Helium

German scientists claim to have made experiments showing that helium can be produced from the mineral monazite, in paying quantities. The discovery was made by industrial research workers studying the extraction of thorium nitrate from monazite sand. They say one gram of the sand heated to 900 deg. C. yields from ½ to 1½ c.c. of helium.

Bureau of Standards Reports on Radiator Solutions

Anti-Freezing Solutions of Alcohol, Glycerine and Ethylene Glycol Show Most Desirable Properties for This Use

The Bureau of Standards, in answer to many inquiries regarding anti-freezing solutions for automobile radiator use, has prepared the following data on four materials which are among the most satisfactory for this purpose:

Table I—Freezing Points (Deg. F.) of Certain Radiator Solutions

Anti-freeze (per cent by volume)	10	20	30	40	50
Denatured alcohol, 180° proof	+27	+19	+10	—2	—18
Methanol	+23	+10	—2	—20	—40
Distilled glycerine (95 per cent by weight)	+29	+21	+12	0	—15
Ethylene glycol (95 per cent by weight)	+26	+16	+3	—11	—31

This table may be used as a safe guide in preparing radiator solutions which will not freeze down to any desired temperature. For example, if the lowest temperature expected is 0 deg., the percentages recommended are either (1) denatured alcohol 37½ per cent, (2) methanol 27½ per cent, (3) glycerine 40 per cent, or (4) ethylene glycol 32 per cent. As these are percentages by volume the quantities to be added per gallon of water are in this case (1) 4¾ pints denatured alcohol, (2) 3 pints wood alcohol, (3) 5⅓ pints glycerine, or (4) 3¾ pints ethylene glycol.

Each of these solutions starts freezing (at the temperature given) with the formation of a slush of ice crystals but it does not freeze solid until a considerably lower temperature is reached. Hence somewhat weaker solutions may be used without serious danger to engine or radiator. The pressure of crystals will, however, usually prevent proper circulation of the radiator solution.

Specific Gravity of Solutions

A table of specific gravities is also given as it is desirable to be able to test the strength of the radiator solution with a hydrometer from time to time.

Table II—Specific Gravities (at 60 Deg. F.) for Certain Radiator Solutions

Anti-freeze (per cent by volume)	10	20	30	40	50
Denatured alcohol	0.988	0.978	0.968	0.957	0.943
Methanol	0.987	0.975	0.963	0.952	0.937
Glycerine	1.029	1.057	1.085	1.112	1.140
Ethylene glycol	1.016	1.031	1.045	1.058	1.070

If the concentration of the alcohol or glycerine used differs materially from that specified in Table I, a corresponding change in the proportion will then be necessary.

The use of methanol containing free acid or of glycerine containing electrolytes (crude glycerine) is unwise, as the presence of such impurities promotes corrosion.

Glycerine and glycol solutions (up to 50 per cent by volume) boil at temperatures only slightly above the boiling point of pure water while solutions of denatured or wood alcohol boil at temperatures considerably below the boiling point of water. Thus the use of glycerine or glycol solutions permits normal engine operating temperatures in winter and since glycerine and ethylene glycol are not lost by evaporation one charge of either will last throughout the season (in the absence of radiator leaks).

Chemical Engineers Convene at Cincinnati

Annual Winter Meeting of American Institute Considers Problems of Chemical Engineering in Industry and Learns Details of Co-operation Between Education and Industry

Editorial Staff Report

MEETING for the first time in Cincinnati, the American Institute of Chemical Engineers held its 18th annual session in that city December 2 to 5. The convention was marked by a spirit of hospitality, thoroughgoing local organization and attention to detail that commanded the approval of all in attendance. Although widely known as a center of chemical activity in certain industries, the Cincinnati district revealed to institute visitors an unsuspected diversity in chemical engineering production, a sober appreciation of its local resources and advantages and an uncommon solidarity in its industrial and educational circles. Hence, from many points of view, the convention was an exceptional success.

Local Industries Portrayed

An introduction to chemical engineering in the Cincinnati district was given in a paper by G. C. Smith, Assistant Professor of Chemical Engineering in the University of Cincinnati. Establishment of the brewing industry in Cincinnati followed logically upon a concentration of German population, so that at one time there were 28 breweries in the district. Accessory industries naturally sprang up to supply copper equipment, valves and pipes, tanks and vats, pumps and other supplies for brewing. Since prohibition, some of these industries have gone out of business, but many of the largest remain.

Of present chemical industries, the manufacture of soap is easily the first in magnitude. The Cincinnati district has 36 soap factories, with an annual value of products of over $100,000,000. Here again allied industries have developed, so that the district is known for the production of glycerol, fatty acids, candles and pitch. Paint and varnish factories number 26, with annual production valued at $10,000,000. Food products, leather, fertilizer, ink, dyes, chemicals and paper products are among the other chemical engineering industries of the district. Factors influencing the selection of industrial sites, such as transportation, water, fuel, power and labor, are all favorable in this area.

Industrial Resources Surveyed

In a paper by C. H. Behre, Jr., executive secretary of the Cincinnati Resource Survey, the author described a co-operative study now being made by the University of Cincinnati, supported by the Commercial Club of Cincinnati and the Union Gas & Electric Co. The purpose of this survey is to study and classify the raw material within a radius of 100 miles of Cincinnati, so that present and prospective industries may be fully advised of the materials at hand for chemical manufacture. This will indicate lines of logical expansion or contraction in industry and will lay the groundwork for specialized studies by consultants who may be engaged later by specific industries. Summary and detailed reports will be published.

Heat Flow in Pyrex Condenser Tubes

The fact that no data are available for designing condensers made from glass prompted J. T. Littleton, Jr., and H. C. Bates of the Corning Glass Works to make an investigation of the flow of heat through Pyrex glass tubes such as are used in the glass evaporator described by Badger and Cutting. (See *Chem. & Met.*, p. 617, July, 1925.) Since the resistance to heat flow under normal conditions is determined largely by the resistance of an assumed surface film, and since this film is dependent to a certain extent upon the smoothness of the surface, it was thought that glass, even though a poor conductor, might show considerably less resistance than its extremely low thermal conductivity coefficient would seem to indicate.

That this was the case was demonstrated in an experimental apparatus in which measurements of the rate of condensation were compared for (1) clean copper tubes, (2) oxidized copper tubes, (3) Shelby steel tubing, and (4) Pyrex glass tubing. The results obtained are shown in the accompanying graph and are summarized in the following conclusion:

"The surface film resistance is practically the controlling factor in the case of metal condenser tubes and volume conductivity has only a small effect. Copper has about six times the conductivity of steel yet it condenses only about ten per cent more steam than the steel. This difference is perhaps due to the surface smoothness of the copper and the absence of scale, for

Comparative Efficiency of Pyrex Glass and Metal Condenser Tubes. The Rate of Condensation in Pounds of Steam Is Readily Converted Into B.t.u.

when the copper was oxidized the condensation value dropped below that of the steel. Copper having a conductivity coefficient of more than three hundred times that of the glass only condenses 2.5 times as much steam as the glass for the more rapid rates of flow."

In discussing this paper, A. E. Marshall, consulting engineer for the Corning Glass Works, called particular attention to the marked difference between the results obtained with clean copper and oxidized copper tubes. They show the importance to be attached to surface film effects. Mr. Marshall stated that experiments would be continued with other materials, such as silica ware and Duriron, the results of which would be published from time to time.

Relation of Corrosion to Alloy Composition

Apparently, most of the non-ferrous alloys of industrial value on account of their useful chemical and physical properties have come into existence by a hit-and-miss process. Hence, an investigation carried on by Lyman J. Wood of Defiance College, in collaboration with Prof. S. W. Parr of the University of Illinois, is of interest because it has revealed some fundamental principles which should be of assistance in further developing corrosion-resisting alloys. Working with several hundred different combinations of copper-zinc-tin, copper-zinc-nickel and copper-nickel-aluminum alloys, it was found that combinations producing alloys of desirable physical properties lie within a comparatively narrow range of composition. In any of the three-component systems, the combinations which have the greatest tensile strength are, for that system, the most resistant to corrosion. The investigators concluded further that both the tensile strength and resistance to corrosion by acid are dependent upon an influence which is an inherent property of the metal and which, in turn, is dependent upon the composition of the alloy.

In the discussion on this paper, Henry Howard inquired whether the authors had studied the effect of heat treatment in increasing resistivity to corrosion. Professor Parr in reply referred to the so-called stainless steels which were not particularly resistive until after heat treatment. Increasing the resistance to corrosion is a problem of decreasing the potential between the constituents of the alloy, and heat treatment apparently accomplishes this effect.

Wastage of Cathode Metals

In a paper by Franklin P. Lasseter and James R. Withrow, of Ohio State University, the authors presented the results of some investigations on the wastage of cathodes composed of platinum, platinum-iridium and tantalum. Experiments were made with a wide variety of electrolytes. As a result of their investigations, the authors find that, contrary to common opinion, platinum is the poorest of the three in resistance to cathode wastage. Platinum-iridium cathodes show the least wastage with various electrolytes for the deposition of metallic copper. Tantalum is a close second to platinum-iridium, and both show a marked superiority over platinum. Tantalum showed no signs of absorption of hydrogen or development of brittleness in ordinary handling, either during or after electrolysis. Quantitatively, tantalum has five-sixths the life of platinum-iridium and sixteen hundred times the life of platinum when used as cathode in copper solutions containing various addition agents during electrolysis. On account of its comparative cheapness, the authors are of the opinion that tantalum should be considered for electrochemical work where the more precious and costly metals have previously been indicated.

Cost of Synthetic Ammonia

Detailed capital and operating costs for synthetic ammonia production and conversion were presented by F. A. Ernst, chief, engineering division, Fixed Nitrogen Research Laboratory, in a paper entitled "Ammonia Production and Conversion Costs."

Discussion was based on a 2-acre plant site with buildings and equipment comprising an electrolytic hydrogen plant, ammonia synthesis plant, sulphate of ammonia plant, storage, bagging and loading plant, shops, steam plant, gas and acid storage, general offices and sidings for a daily production of 40 tons of sulphate of ammonia. The total cost of such a plant was estimated to be $873,790, apportioned as follows: Auxiliaries, $32,285; hydrogen plant, $428,444; ammonia plant, $231,568; sulphate plant, $140,493; storage plant, $41,000. However, it was proposed to have $226,210 initial current assets, thus making a total initial paid-in capital of $1,100,000. Of this investment $746,177 was charged to ammonia and $353,823 to sulphate of ammonia production, to serve as a basis for operating cost accounting. Operating overhead, however, was charged on an arbitrary basis of ⅓ to ammonia and ⅔ to sulphate.

On the basis of the foregoing, the summary costs for ammonia production were as follows:

Power, 6,000 kw. at $30	$180,000
Direct labor	27,600
Catalyst	625
Supplies	1,500
Repairs	25,000
Overhead	19,433
Insurance and taxes at 2 per cent	14,924
Amortization at 20 per cent	149,240
Royalty	8,537
Total, including hydrogen cost	$426,859

This corresponds to a cost of $121.96 per ton of ammonia, or 6.01c. per lb.

Likewise the summary costs for sulphate of ammonia were:

Ammonia gas	$426,859
Sulphuric acid, 60 deg., at $7	98,000
Power, 50 kw. at $30	1,500
Supplies	2,940
Repairs	5,600
Direct labor	41,700
Overhead,	38,867
Bagging and loading	7,000
Insurance and taxes at 2 per cent	7,076
Amortization at 20 per cent	70,760
Total sulphate cost	$700,302

This corresponds to a cost of $50.02 per ton of sulphate.

Assuming the detailed equipment costs to be correct, several phases of the financial reasoning appeared to be open to question. For example, it was stated that:

> The plant will be amortized at the rate of 20 per cent per year, so that at the end of 5 years, the capital invested will be entirely paid off, or at least will be taking care of itself either by being paid up, by being put to work, to take care of its interest charges, or by a stock readjustment. This then means that ammonia during the second year of operation will cost less than the cost during the first year, by the amount of earnings of the 20 per cent of $746,177.

Likewise the cost during the third year will be less than during the second by a like amount until during the sixth year and thereafter, other conditions not changing, the cost of ammonia will be $746,177 × 0.20 ÷ 3,500 = $42.64 less per ton than was the cost the first year.

This paper was the subject of critical discussion by several members who differed radically with the author's estimate of cost and methods of accounting. R. S. Tour, Professor of Chemical Engineering in the Univeristy of Cincinnati, felt that all estimates were too low and that the cost of ammonia would be twice the figure given by the author. In Mr. Tour's opinion, the estimated cost should not be reduced annually on account of amortization, and he also challenged the arbitrary division of operating costs and operating overhead one-third to ammonia and two-thirds to ammonium sulphate. A. E. Marshall criticized the cost of ammonium sulphate production as to repairs, labor, overhead, bagging and loading. The use of electrolytic hydrogen was also criticized on account of the expense of the process under ordinary conditions. In this connection, Henry Howard asked whether byproduct hydrogen from the manufacture of carbon black had been investigated as a source for synthetic ammonia, and Mr. Ernst stated that the proposal is now being looked into. Time did not permit Mr. Ernst to reply in full to his critics, and his comments will be published in the Transactions of the Institute.

Industrial Water Supply

Water supply, as pointed out by W. D. Collins of the U. S. Geological Survey, is obviously only one of the many factors influencing the selection of a site for a chemical or other manufacturing plant. Whether public supplies should be used or other private sources developed depends on economic conditions, with quantity a controlling factor. Likewise, the chemical quality of the water, that is, its hardness and its corrosive property, is subject to definite evaluation in terms of cost of treatment or loss of efficiency in operation. Mr. Collins exhibited a number of charts showing graphically the properties of various surface and ground waters in different parts of the United States, and pointed out the relation of these properties to industrial application.

Co-operative Engineering Education

Engineering education in the University of Cincinnati is characterized by a system of co-operation with industry inaugurated and developed by Dean Herman Schneider. In an informal address, Dean Schneider outlined the scheme now in vogue and traced its development since its introduction in 1906. The system comprises a sequence of training in the theory and principles of engineering in the university, with a sequence of training in the application of science and engineering in an industrial plant, both being co-ordinated under the direction of the university. About 250 firms now co-operate with the university in this work, and 1,400 students spend alternately four weeks in the university and four weeks in industrial plants, two students being assigned to each industrial job. For their industrial work they receive the same rate of pay as other employees doing similar work.

In chemical engineering, which is under the direction of Prof. R. S. Tour, the co-operative system is in vogue with 50 manufacturers of chemical and related commodities. Lectures and laboratory work are given intensively for four weeks, after which the students go to the industrial plants to which they have been assigned, where they relieve co-operative students who return to the university for four weeks. The full course requires five years for completion. The work in industry is continuous throughout the year, but there are short university vacations totaling four weeks in the year. A co-ordinator in chemical engineering has supervision and control of the industrial work of the students. The course is strenuous, the mortality between entrance and graduation being 80 per cent. The student may or may not remain in the same plant throughout his course, and on graduation may or may not enter the employ of the company with which he was a co-operative student. The plan has certain obvious advantages to both faculty and students, which are felt to outweigh any disadvantages arising from the repeated breaks in continuity of the work.

Constitution and Properties of Ternary Acid Systems Determined

A comprehensive study on "The Solid-Liquid Temperature Relation in the Ternary System H_2SO_4 — HNO_3 — H_2O and Its Relation to the Ternary System N_2O_5 — H_2O — SO_3" was presented by Clifford D. Carpenter. It was shown that no compounds of sulphuric and nitric acids exist, but the constitution and properties of certain ternary compounds were definitely established. The entire paper, which is a continuation of the liquid-vapor phase studies published previously (Carpenter and Babor, *Chem. & Met.*, 1922, vol. 26, p. 443; 1922, vol. 27, p. 121; 1924, vol. 31, p. 260), will appear in a forthcoming volume of the *Transactions* of the Institute.

Research by Trade Associations

As typical of the researches which have been carried on by trade groups the following subjects, together with the associations reporting them, are listed in a recent bulletin of the U. S. Chamber of Commerce:

Activity and capacity of iron oxides for gas purification—American Gas Association.

Effect of diastatic enzymes upon starch of wheat flour—American Bakers Association.

Deterioration of cast iron pipe lines—American Petroleum Institute.

Heat losses from bare surfaces—Magnesia Association of America.

Toxicity of foods with special reference to botulism—National Canners Association.

Fungi attacking southern pine lumber—Southern Pine Association.

Acoustic properties of hollow tile—Hollow Building Tile Association.

Overload capacity of leather belting—Leather Belting Exchange.

Causes of casting defects—American Malleable Castings Association.

Acidproof mortar for setting tile—Associated Tile Manufacturers.

Fatigue limits of non-ferrous metals—Copper and Brass Research Association.

Sterilization of food products in glass—Glass Container Association.

Decay of pulp wood—News Print Service Bureau.

Efficiency of farm machinery in fertilizer distribution—National Fertilizer Association.

Kiln drying processes—Northern Hemlock and Hardwood Manufacturers Association.

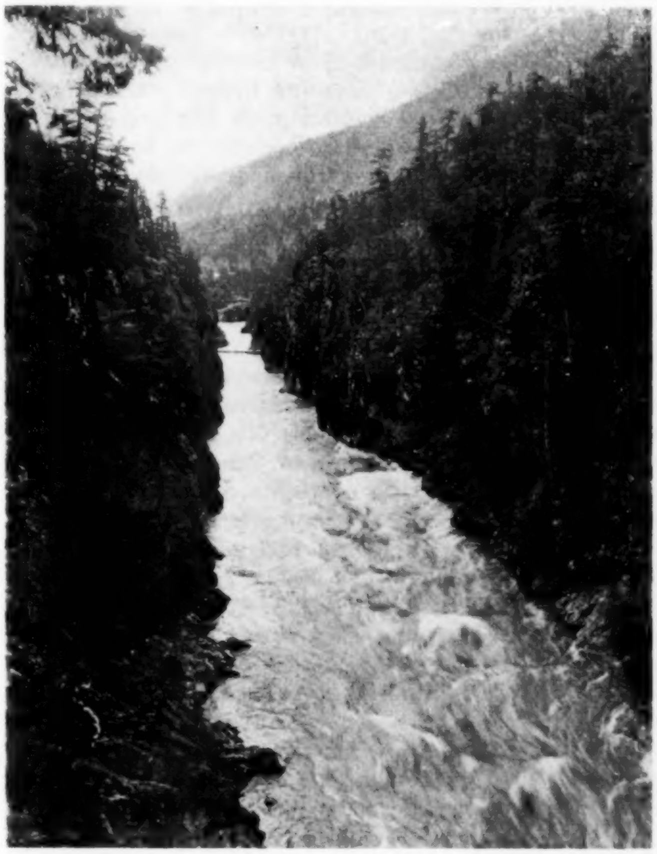
Improvements in methods of manufacture — Portland Cement Association.

Nitrogen Fixation in the State of Washington

Cheap Hydro-electric Power Should Encourage Development of Other Electrochemical Industries in the Far Northwest

By H. K. Benson
Professor of Chemical Engineering, University of Washington

THE preponderance of hydro-electric power in the State of Washington has been favorable to the establishment of certain types of industry that are usually considered impracticable in other portions of our country. In Washington, 94 per cent of the electric power is produced by water power, although in the United States as a whole, nearly two-thirds of the output comes from fuel and only 34 per cent of the total is obtained from water power. From developed power plants in the State, nearly 500,000 hp. is obtained, and undeveloped sites are estimated to produce 8,000,000 hp. more. The three Pacific Coast states have a combined available water power of 23,078,000 hp., or 42.8 per cent of the total available water power in the United States.



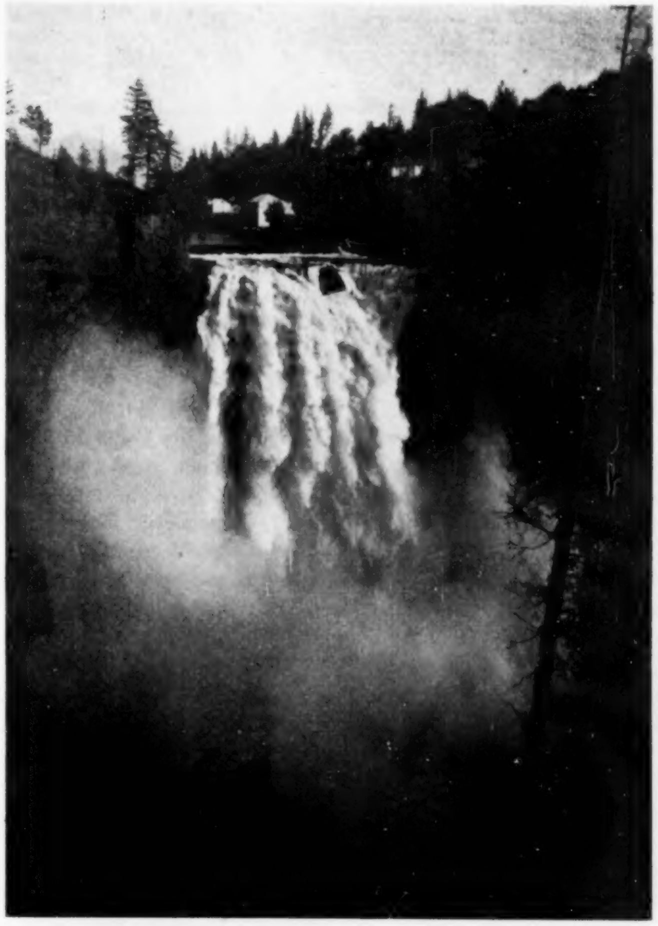
Skagit River, Part of the Seattle Power Development

Of the various nitrogen fixation methods, the arc process although conceded to be simplest and cheapest for the production of nitric acid, has always been considered as applicable only to Norway where this process has become established in connection with water-power power plants and where an operating capacity of some 30,000 tons of fixed nitrogen has been developed.

The La Grande power plant normally generates 25,000 hp. This power is sold at $39 per kw.-yr. for industrial power and waste power sells for $10 per kw.-yr. The city of Tacoma has a second project under development at Lake Cushman where a total of 50,000 hp. is available.

Cedar River, Another of Seattle's Power Sources

Through the interconnection of transmission lines the plants of the city of Seattle also can feed their surplus power into the nitrogen fixation plant. The municipal power plants of Seattle utilize the Cedar and Skagit Rivers. At Cedar River, 25,000 kw. is generated and is transmitted 36.5 miles at 60,000 volts. The Skagit plant generates 39,000 kw. and transmits at 154,000 volts a distance of 105 miles. From these plants is offered industrial power at $30 per kw.-yr. and waste power at $9 per kw.-yr.



Snoqualmie Falls, Harnessed by the Puget Sound Light and Power Company

Hydrating Lime for Bleach Manufacture

Strength and Stability of Chlorinated Calcium Hydroxide Shown to Be Function of Water Content

By D. F. Richardson, W. E. Emley and J. M. Porter
U. S. Bureau of Standards

THE results given herewith are the outcome of the Interdepartmental Conference on Chemical Lime, which is engaged in preparing specifications for lime used in the various chemical industries.

Bleaching powder, as is well known, is the product resulting from the direct action of chlorine gas upon calcium hydrate. Its strength, or, as usually stated, its available chlorine content, depends on several factors. A pure lime is known to be necessary for a good product; many impurities affect the rapidity and completeness of the chlorination and also the keeping qualities. Another important factor, and the one forming the subject of the present investigation, is the proportion of water used in hydrating the lime. On both of these points the data are few and somewhat conflicting.

The original material used in this investigation was chemically pure quick lime ground in a ball mill for $1\frac{1}{2}$ hr., and screened through a No. 14 sieve. It had the following analysis:

Acid insoluble	0.32 per cent
Silica (SiO_2)	0.23 per cent
Loss on ignition	6.61 per cent
Iron and aluminum oxides (Fe_2O_3 and Al_2O_3)	0.09 per cent
Magnesium oxide (MgO)	0.37 per cent
Chloride (Cl)	0.004 per cent
Sulphate (SO_4)	0.32 per cent
Phosphate (PO_4)	0.032 per cent
H_2S metals	none
Lime (CaO) by difference	92.34 per cent

The ground material was then bottled until ready for use. There was some exposure to the air resulting in a slight amount of air slaking of the lime during this process. The lime was next slaked by adding a known weight of lime to a definite amount of water. The maximum temperature during this process, and the time required to reach this temperature, were noted, and the resulting hydrate allowed to cool over night. The maximum temperature was usually greater than 100 deg. C., and consequently some water was lost by evaporation.

To investigate a few other factors, three special hydrates were prepared. The first of these was made by adding the lime to a large excess of water, allowing the mixture to stand for several days, and after decanting the excess water, drying the resulting hydrate in an oven at 120 deg. C. The second of these special samples was made by slaking the lime to a putty, using a considerable excess of water, drying the product in the oven at 120 deg. C, and grinding. The third sample was slaked with and cooled by steam, the sample being allowed to remain in a steam bath for 20 min.

The hydrates, after being prepared as above, were analyzed. Free water was determined by the loss in weight on heating in an oven to 105 deg. to 110 deg. C. Loss in weight on ignition was found in the usual manner. An approximate method was used to determine the calcium carbonate, calcium oxide, and calcium hydroxide. A suspension of the hydrate in water was titrated with hydrochloric acid, first using phenolphthalein as an indicator, and again using methyl orange. Twice the difference between the volume of acid required for the two titrations, multiplied by the calcium carbonate equivalent of the acid used, gives the carbonate present. From this result the carbon dioxide present is readily obtained. If the percentages of carbon dioxide and of free water are subtracted from the per cent loss on ignition, the difference is the percentage of combined water, or water as calcium hydroxide, from which the calcium hydroxide percentage is easily calculated. The volume of acid used on titration of the suspension with phenolphthalein, less the difference between it and the volume of acid necessary in the methyl orange titration, gives the acid required to neutralize the calcium oxide and hydroxide. The percentage of calcium hydroxide having previously been determined, the percentage of calcium oxide is readily obtainable.

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The analyses of the foregoing hydrates are given in Table I. The second column gives the percentage of water based on the weight of quicklime, to which the lime was added in making the hydrate; and the third gives the maximum temperature reached during hydration. Samples Nos. 30, 31, and 32 are the three special samples to which reference has already been made: No. 30 being the hydrate made with a large excess of water, No. 31 the hydrate made from putty, and No. 32 is the steamed hydrate.

As would be expected, the percentage of $Ca(OH)_2$ increases and that of CaO decreases, as the percentage of water increases. Up to Sample No. 20, which is that hydrated with $47\frac{1}{2}$ per cent of its weight of water, no free water appears; above this the amount of free water steadily increases. Samples Nos. 21 and 22 show comparatively large amounts of free CaO; with these exceptions, from sample No. 20 on, the percentage of CaO is very small. Samples Nos. 21 and 22 have been subjected to microscopic examination, and no such percentage of free calcium oxide as reported could be detected. As well as could be estimated, less than five per cent was present. The abnormal results, then, may be credited to the inherent inaccuracies of the method of analysis. The percentage of $CaCO_3$ is rather high in some cases, but manifests no regularity in its relation to the percentage of water.

Chlorination of the Hydrate

The process of chlorination used was very simple, resembling in this respect at least that used in practice. Chlorine was generated by the action of HCl on manganese dioxide in a Kipp generator, the resulting gas being led into an Erlenmeyer flask on the bottom of which the sample of hydrate was spread in a thin layer. About 10 gm. of hydrate was used in each case. Care was taken to have the same pressure in the flask at the start in each case. Each sample was exposed to the chlorine for 24 hr. and at the end of this time its increase in weight was determined.

Immediately after the completion of the chlorination process the bleaching powder produced was analyzed for available chlorine, using the method of Wagner (Lunge, "Soda-Industrie," vol. III, 2nd edition, p. 379).

The bleaching powder was next bottled, placed in subdued light, and allowed to stand for 30 days when its chlorine content was again determined. This figure gives a much better idea of the useful chlorine content

Table I—Analyses of Hydrates

Sample No.	Water for Hydration, Per Cent	Maximum Temperature of Hydration, Deg. C.	Free Water, Per Cent	$CaCO_3$, Per Cent	$Ca(OH)_2$, Per Cent	CaO, Per Cent	Total Per Cent
1	0	...	0	6.38	25.85	65.00	97.23
2	2.5	34	0	5.18	35.30	57.80	98.28
3	5	47	0	5.34	40.65	52.3	98.29
4	7.5	85	0	7.36	45.05	45.9	98.31
5	10	120	0	7.07	63.45	30.3	100.82
6	12.5	133	0	7.47	56.90	34.3	98.67
7	15	146	0	6.98	63.40	28.6	98.98
8	17.5	131	0	5.52	68.80	22.9	96.22
9	20	154	0	8.25	67.90	22.6	98.75
10	22.5	169	0	13.51	76.30	10.05	99.86
11	25	159	0	12.50	74.70	11.75	98.95
12	27.5	133	0	9.94	66.75	20.9	97.59
13	30	123	0	7.93	78.75	12.15	98.83
14	32.5	185	0	5.63	78.75	16.3	100.68
15	35	154	0	5.75	78.40	15.65	99.80
16	37.5	168	0	5.47	81.10	12.65	99.22
17	40	125	0	5.59	83.00	10.75	99.34
18	42.5	107	0	2.02	91.50	5.5	99.02
19	45	102	0	4.63	90.75	3.9	99.28
20	47.5	101	0.18	4.13	93.60	1.15	99.06
21	50	101	1.18	5.09	81.80	9.8	97.87
22	55	101	3.86	4.77	78.90	10.8	98.33
23	60	100	4.56	5.02	87.10	3.3	99.98
24	65	100	8.28	3.89	82.70	4.35	99.22
25	70	100	6.77	7.07	85.50	0.15	99.49
26	75	100	9.67	4.77	84.20	1.5	100.14
27	85	100	20.92	1.84	75.20	1.35	99.31
28	92	99	24.90	1.27	67.70	3.9	97.77
29	100	130	28.50	1.16	63.70	5.75	99.11
30	....	...	0	8.79	84.40	5.1	98.29
31	....	...	5.09	4.18	85.80	4.35	99.42
32	....	...	23.90	4.50	66.10	5.0	99.50

of the material than does that determined on the fresh powder, and it also gives some idea as to the keeping quality of the bleach, which is extremely important in practice. The apparent density of each sample of bleaching powder was also determined by the method ordinarily employed.

Still a third test was made upon each sample of bleach: estimating the rate of settling from water. This property is an important one in practice, as bleaching powder is used chiefly as a suspension. The method was to suspend, by vigorous shaking, 1 gm. of the powder in 100 c.c. of water in a graduated cylinder. The height of the residue settling at the bottom was read every 10 min. The condition of the liquid above the residue, and the level to which the clear liquid, if any, descended were noted also. These results are, on the whole, disappointing, as they vary widely with no apparent relation to apparent density, chlorine content, or any other factor.

Results of the tests on the bleach are shown in Table II. Some few of these results, as those in the case of the hydrates, seem abnormal, as for example, sample No. 15, which lost 10.4 per cent available chlorine in 30 days' storage, but on the whole they are more regular than this. The available chlorine increases with the water used in hydration, both for the fresh sample and for that stored for 30 days, regularly to a maximum, remains practically constant through Samples Nos. 14 to 22, when it falls off sharply. Sample No. 30, the crystalline hydrate prepared from a large excess of water, gave a very good bleach, as did the hydrate prepared from the lime putty, No. 31. No. 32, the hydrate made by steaming the quicklime, did not give such a good bleaching powder as would be expected, because of its extremely large excess of free water. Excess of water, shown in samples from No. 23 onward, had a very pronounced effect in decreasing the available chlorine content.

In order to produce an entirely satisfactory bleaching powder for commercial use the amount of water used in hydration of the quicklime should be carefully con-

Table II—Chlorine Analyses

Sample No.	Water for Hydration, Per Cent	Available Chlorine: Fresh, Per Cent	Available Chlorine: at 30 Days Per Cent	Loss in 30 Days, Per Cent	Apparent Density gm. per c.c.
1	0	....	....	....	.....
2	2.5	....	....	....	.....
3	5	....	....	....	.....
4	7.5	....	30.0	....	0.523
5	10	....	....	....	0.340
6	12.5	34.5	34.8	—0.3	0.473
7	15	30.6	29.15	+1.5	0.402
8	17.5	39.2	35.5	3.7	.....
9	20	35.0	34.7	0.3	0.453
10	22.5	25.9	24.2	1.7	0.359
11	25	31.5	30.0	1.5	0.364
12	27.5	36.6	35.2	1.4	0.418
13	30	33.3	33.2	0.1	0.400
14	32.5	40.3	39.0	1.3	0.528
15	35	42.3	31.9	10.4	0.472
16	37.5	43.1	39.4	3.7	0.483
17	40	42.4	38.9	3.5	0.460
18	42.5	41.2	36.9	4.3	0.465
19	45	42.8	40.4	2.4	0.533
20	47.5	44.4	40.2	4.2	0.543
21	50	42.8	38.2	4.6	0.603
22	55	43.2	37.8	5.4	0.582
23	60	34.0	29.6	4.4	0.514
24	65	33.6	29.9	3.7	0.600
25	70	36.4	29.6	6.8	0.647
26	75	38.2	34.8	3.4	0.700
27	85	38.8	35.1	3.7	0.810
28	92	35.0	23.8	11.2	.....
29	100	18.1	12.1	6.0	.....
30	....	41.7	38.2	3.5	0.705
31	....	43.2	39.2	4.0	0.825
32	....	28.4	23.7	4.7	0.770

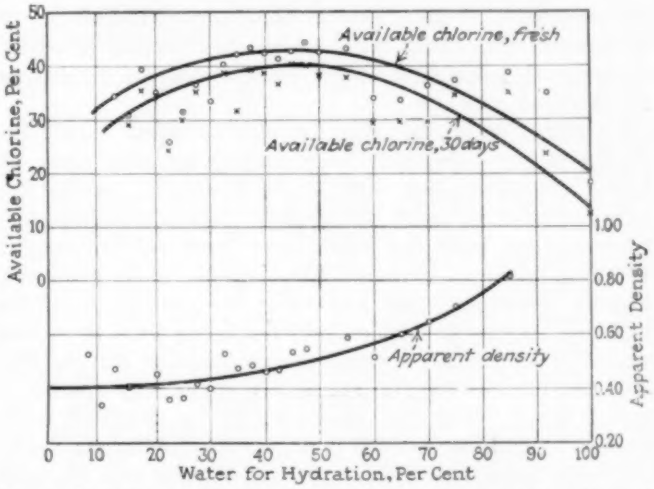


Fig. 1—Relation of Water of Hydration to Apparent Density and Available Chlorine in Bleaching Powder

trolled; but the care required is not more than can be easily applied in practice. The range of water of hydration for such a bleach is wide enough so that unavoidable errors in quantities used will not appreciably affect the quality of the product. The percentage range found in this work to give best results is from 32½ to 55 per cent of water, based on the weight of quicklime used. The most satisfactory product was obtained between 45 and 50 per cent in which the lime was almost completely hydrated, little or no free water being present. It has previously been considered that about 4 per cent excess water gave the best results (Lunge, *loc. cit.*, pp. 372-3), but this work, while showing a good bleaching powder to be made from such a hydrate, indicates that the amount of free water should be somewhat less, since the strength of the bleach falls off very rapidly with increased water above this point. Thus a small error causing the addition of a little too much water would cause a serious loss in strength of the product. Forty-five per cent of water, based on the weight of lime, could well be recommended, since this is well within the limits prescribed.

Economic and Technical Characteristics of Chemical Manufacturing

Analysis of the Chemical Engineering Industries Reveals Fundamental Factors in Production, Marketing, Accounting and Finance, Cognizance of Which Should Assist in Formulating a Sound Administrative Theory

By Chaplin Tyler
Assistant Editor, *Chem. & Met.*

ANALYSIS of manufacturing activities reveals a large group of industries in which the form utility of the raw materials is increased through the application of chemical engineering unit processes or operations, such as heat flow and combustion, fluid flow, disintegration, mechanical separation, filtration, evaporation, distillation, drying, absorption and mixing. Furthermore, these raw materials with but few exceptions, undergo chemical change, as well as change in physical form and appearance. Change in chemical composition is therefore the fundamental technical characteristic of the chemical engineering industries as contrasted with other types of manufacturing, in which mechanical processing alone is the means of producing the finished product.

Chemical manufacturing, in the broadest sense, includes many apparently unrelated industries, such as heavy chemicals, fine chemicals, dyestuffs, explosives, coke byproducts, wood distillation, electrochemicals, fertilizers, soap, pulp and paper, petroleum refining, sugar refining, rubber, cement, lime, glass, clay products, leather tanning, paint and varnish, plastics, artificial textiles, vegetable oils, carbon black, natural dyes and extracts, fermentation products, glucose and starch. But however diverse the foregoing industries may appear to be, all have a common denominator in chemical technology. Chemical science is at the root of nearly every industry enumerated, and chemical control and the unit operations of chemical engineering are essential to all of them. Fundamentally at least, the technical experience gained in one industry, can effectively be applied to the others as well.

Expressed in terms of value of products, the chemical engineering group comprises 19.3 per cent of all manufacturing industries, and in terms of capital invested, it has even greater importance, being 24.4 per cent of the total. This analysis includes ferrous-metal blast furnace operations and also the smelting of non-ferrous metals such as copper, lead and zinc; but it does not include steel making, textile finishing, rayon, proprietary medicines, cosmetics, dehydrated foods and many other products in which chemical control, change of composition and other essential characteristics of this group generally predominate. However, some of these might be termed borderline industries, of which there are all shades, from those purely empirical, to those carefully controlled by science.

Production Characteristics.—With but few exceptions, change in chemical composition constitutes the fundamental production characteristic of the chemical engineering industries as herein defined. Chemical control therefore plays a most important part in the manufacturing processes, as by this means alone can production be guided, and quality determined. In order to bring about the desired changes in chemical composition, it is usually necessary either to supply or to remove energy at some stage of the process. More commonly, energy in the form of heat has to be supplied to make the principal reaction go to completion. Furthermore, heat is required for many of the unit operations, such as those in which separation with change of phase occurs, as in distillation, evaporation and drying. Electric energy obviously must be supplied in the electrolytic and arc-reaction processes, and also for certain processes requiring exceptionally high temperatures, as in electric furnace technology.

Just as the flow of energy, usually heat, is common to the chemical industries, so there are other definite unit operations in chemical engineering, the suitable combination of which constitute an industrial process. Although the list of unit operations can be extended almost indefinitely, the important ones are comparatively few in number. Among these are heat flow and combustion, fluid flow, disintegration, filtration, evaporation, distillation, drying, absorption, mechanical separation, and mixing and agitation. This continuity of unit operations is illustrated by Table II, which includes some representative industries of the chemical engineering group.

Depreciation of buildings and unit operation equipment is ever the source of concern to the chemical

Table I—Magnitude of Chemical Engineering Industries, Calculated from the Census of Manufactures, 1923

Industries (Value of Products Exceeding $100,000,000)	Number of Plants	Average Number of Wage Earners	Value of Products	Capital Invested (1919)
			(Thousands of Dollars)	
Acids, heavy Chemicals and Coal-Tar Products	773	77,254	655,275	710,640
Cement	133	35,091	264,098	271,269
Clay products	2,287	.139,547	447,808	422,606
Coke byproducts	262	28,364	516,923	365,250
Condensed and evaporated milk	378	8,723	200,111	126,953
Corn sirup, oil and starch	31	6,537	116,560	58,183
Fertilizers	573	18,572	183,089	311,633
Glass	333	73,335	309,353	215,680
Iron smelting	169	36,712	1,007,613	802,417
Leather tanning	597	59,703	488,898	671,342
Manufactured gas	939	42,282	450,097	1,465,656
Non-ferrous metal smelting	89	39,104	964,169	543,342
Paint and varnish	826	22,818	404,134	239,776
Paper and wood pulp	746	120,677	907,347	905,795
Petroleum refining	382	66,717	1,793,700	1,170,278
Rubber industries	529	137,868	958,518	960,071
Soap	270	17,002	276,403	212,417
Sugar industries	226	25,645	871,736	473,243
Vegetable oils (1921)	883	21,272	381,532	368,886
Other industries (value of products less than $100,000,000)	2,509	95,438	513,345	580,006
Total, chemical engineering industries	12,935	1,072,661	11,710,709	10,875,443
Total, all manufacturing industries	196,309	8,778,156	60,555,998	44,466,594

Table II—Showing the Continuity of the Major Unit Operations of Chemical Engineering in Representative Industries of This Group

Industries / Unit Operations	Heat Flow, Combustion	Fluid Flow	Disintegration	Filtration	Mechanical Separation	Evaporation	Distillation	Drying	Absorption	Mixing and Agitation
Acids and other chemicals	x	x	x	x	x	x	x	x	x	x
Cement	x	x	x	....	x	....	....	x	....	x
Clay products	x	x	x	x	x	....	....	x	....	x
Coke byproducts	x	x	x	x	x	....	x	x	x	x
Explosives	x	x	x	x	x	....	....	x	x	x
Extracts, natural	x	x	x	x	x	x	....	x	....	x
Fertilizers	x	x	x	x	x	x	....	x	x	x
Glass	x	x	....	....	x	....	....	x	....	x
Glue and gelatine	x	x	x	x	x	x	....	x	x	x
Leather tanning	x	x	....	x	x	....	....	x	x	x
Paint and varnish	x	x	x	x	x	....	....	....	....	x
Paper and wood pulp	x	x	x	x	x	x	....	x	x	x
Petroleum refining	x	x	....	x	x	....	x	....	x	x
Rubber industries	x	x	x	....	x	....	....	x	....	x
Soap and glycerine	x	x	x	x	x	x	x	x	....	x
Sugar industries	x	x	x	x	x	x	....	x	x	x
Starch and glucose	x	x	x	x	x	x	....	x	x	x
Vegetable oils	x	x	x	x	x	....	x	x	x	x
Wood distillation	x	x	x	x	x	x	x	x	x	x

plant executive. The reasons therefor are plain. In the first place, operating conditions are extremely favorable to chemical corrosion, thermal breakage, and mechanical wear and tear. Secondly, technical advance may render equipment suddenly obsolete. Usual practice in the chemical industries is to amortize the investment in operating equipment every 10 years; but to set uniform rates of depreciation for the entire group would be impossible. In the coke byproducts, iron smelting, leather tanning, paint and varnish, paper and wood pulp, rubber, and sugar refining industries it is possible to establish fairly accurate rates, but the only satisfactory plan, in view of wide variations in operating conditions would seem to be individual standards for each plant. Especially is this true of the acids, heavy chemicals, dyestuffs, fertilizer, manufactured gas, and petroleum refining industries, in which conditions are extremely variable. For example, take the life of an evaporator. Under favorable conditions it should serve 30 yr., but an average for usual conditions is probably nearer 20 yr., and with corrosive liquors, 3 to 5 yr. might be the maximum.

Research and development, desirable in every type of industrial enterprise, is a practical necessity in the chemical engineering industries. The ever-changing technology of the newer industries, and the need for change in some of the older ones, makes generous appropriations for research sound business policy. In general, a balanced program directed along 5 distinct lines, is characteristic: (1) Substituting alternate raw materials and processes, (2) decreasing production cost by increasing yield and operating economy, (3) improving quality of product, (4) finding new outlets for finished products and byproducts, and (5) developing new products.

Research the Basis of New Industries

Entire industries, particularly those born during the past quarter century, owe their present economic position to scientific research and chemical engineering development. To illustrate the profound effect of research on industry, note the following quotation from a speech made by B. C. Hesse in 1914:

> While at the present day it may not be commercially profitable to produce synthetic rubber, or synthetic camphor, or synthetic nitric acid, or synthetic ammonia, yet it is perfectly true that the very existence of these possible synthetic sources of these materials renders it less likely that there will be any undue advance in the cost to the consumer of these articles; at any rate the cost will not be advanced beyond a figure where the synthetic process can achieve a reasonable profit.

And today, of the 4 products cited by Dr. Hesse, 3 already have attained commercial success, and the fourth, cheap synthetic rubber, seems to be on the horizon. The keynote of modern chemical industry was struck by A. D. Little when he said: "Science is now advancing at a rate so rapid and with results of such far-reaching influence that no industry can hope to ignore research and live."

Chemical reactions, especially when conducted on an industrial scale are extremely sensitive to external influences and hence precise scientific control is a necessary feature of factory production. The basis of this type of control is the rigid inspection of raw materials and a close scrutiny of operation, both of which require adequate laboratory facilities, proper measuring devices, and an operating force properly instructed and highly intelligent. Routine chemical analyses are necessary if uniformity of product is to be attained; precise measurement of materials, steam, power, and supplies is essential to accurate cost accounts; and finally, power plant and process efficiency must be checked periodically by engineering tests.

Manual Skill Being Transferred to Equipment

Closely related to the problem of chemical control is that of factory personnel. Manual skill is of comparatively little necessity, except in a few industries such as glass, clay products, and leather tanning, in which the art has long antedated science. But it is safe to say that the gradual incursion of modern technology into these industries will make skilled handicraft of less relative importance in the future. However, lack of manual skill does not connote low-grade labor; in fact to operate chemical equipment efficiently and safely requires a high level of intelligence. During 1923, the value of products produced per wage earner was $10,940 in the chemical engineering group, as against $6,360 per wage earner in all other manufacturing industries, thus indicating a significant substitution of equipment for labor.

To insure success, the chemical enterprise must be of sufficient size to realize the advantages of large-scale production. The average manufacturing plant in the chemical engineering group represents $843,000 invested capital, as against only $183,000 for each plant in all other industries. In 1919, the average petroleum refinery had $3,660,000 invested capital, and the average cement mill represented $2,210,000. For the manufacture of rayon, it has been estimated that the minimum economic unit is one having $3,500,000 of capital.

Large-scale production on a continuous or semi-continuous basis, is the rule in chemical manufacturing. The economies inherent in large units is even more pronounced here than in the mechanical process industries, as a doubling of capacity of a still, evaporator, rotary filter, kiln or other unit necessitates very little if any extra direct labor and no additional supervision.

Naturally in an industry in which small margins and mass production are the rule, the profitable utilization of byproducts is an important consideration. In fact, so highly developed is this feature of chemical manufacturing that it is often difficult to differentiate the principal product from the various byproducts.

Such is often true in heavy chemicals manufacture, oil refining, and coke byproducts. The byproduct of the present may be the principal product of the future, depending on technical advance and external economic factors. Akin to byproduct utilization is waste heat and exhaust steam utilization. In nearly all chemical industries, neglected opportunities exist in power development, and in process steam requirements this group presents some interesting engineering problems.

Marketing Characteristics—Products of plants the output of which is strictly chemical in both product and process, are largely raw materials for other industries and hence are not marketed direct to the consuming public. Included in this category are acids, heavy chemicals, salt, chemical lime, and coal-tar products, all of which are truly the raw materials of industry. By far the greater proportion of the foregoing chemicals are consumed by other industries, most of which belong in the chemical engineering group.

Unquestionably an outstanding marketing characteristic of the group is the profitable disposal of byproducts, those materials that often are a determining factor in the success or failure of a chemical enterprise. Because of the nature of chemical processes, byproducts result whether or not they are salable, and the maintenance of a good equilibrium among principal products and byproducts is perhaps the point of perfection in chemical marketing. Inspection of many heavy chemical plants will reveal large quantities of calcium carbonate mud, iron oxide and calcium sulphate, the presence of which shows that satisfactory outlets for these byproducts, or rather waste products, are lacking.

More Engineering Needed in Marketing

Another important characteristic of chemical marketing is the necessity of sales engineering effort, or at least of the closest possible co-operation between the chemical staff of the production department with the sales staff. And incidentally, sales engineering is essential to the service that every chemical manufacturer should have at his command. It is probably the most effective means of approach to the development of present markets and the creation of profitable new outlets.

A marketing consideration of vital importance in chemical manufacturing is radius of shipment. Many products of this group, such as fertilizers, cement, lime, coke, sulphuric acid, and certain petroleum fractions have a comparatively low bulk value and hence the market is limited by shipping costs. Speed of delivery is another limiting factor. In his report, "The Problems of Muscle Shoals," Charles H. MacDowell shows the relation of the foregoing factors to the marketing problems of the fertilizer industry:

> Because of the very short shipping season and the consequent car and labor shortage and delay in delivery, experience has shown that a number of comparatively small units scattered through the consuming districts are preferable to large central plants. Comparison shows that for high-grade fertilizers . . . small plants in the heavy consuming districts would for the most part have the advantage over Muscle Shoals when considering raw material costs and out-freight.

Probably the extreme example of limitation in distribution is that of illuminating gas. There appears to be some promise of developing high-pressure mains, with greatly increased marketing radius, but at present the producer and consumer must be close together geographically.

A less fundamental factor in chemical marketing, but nevertheless, one of great importance, is that of proper packaging. The Interstate Commerce Commission, by regulatory measures, has required chemical industry to conform to minute specifications in packaging flammable, explosive, corrosive or otherwise hazardous commodities. Great pains have been taken to develop special containers, many types of which represent a heavy investment in time and money. The steel tank car for oil of vitriol, the rubber-lined tank car for muriatic acid, the forged-steel cylinder for highly compressed and liquefied gases, and the export carboy for acids are but a few of the specialized returnable containers developed by the chemical engineering industries.

Accounting Characteristics.—Although the general theory of accounting applies equally well to all types of business, chemical manufacturing has special problems, particularly in cost finding, that are worth noting. First, a suitable method of costing the product must be chosen. In general, either the unit operation method, or the process cost method is used in chemical plants, as production does not permit of job costing, unless a special discontinuous batch of the product is made.

Finding Unit Operation and Process Costs

Unit operation costs are desirable when the number of such operations is not too great, and when sharp separation for accounting purposes is possible. This type of record gives a direct comparison with the standard cost for the operation, and indirectly on operating efficiency as well. It is applicable to the cement, lime, pulp and paper, petroleum refining, salt, and sugar industries, in which certain major unit operations such as crushing, drying, evaporation, distillation and combustion are of extreme importance from a cost standpoint. Obviously, unit operation costing presupposes ease of measuring the material in process, and hence it is not applicable to all branches of the industry.

When it is difficult to obtain unit operation costs, the process cost method must be used, this being the alternative method widely applicable to chemical industry. Thus in the manufacture of products in which a succession of reactions occur, as in making synthetic organic chemicals, the measurement of intermediate products is not generally feasible, and hence these closely related operations are considered collectively, at least for accounting purposes.

Chemical yield, and consequently process cost, is based on measurement of the product, and this introduces another phase of chemical plant accounting, namely, the necessity of attaining reasonable precision. Raw materials, fuel, power, and process steam must be measured. Suitable weighmeters, fluid meters, or other devices are required, and the proper maintenance of such equipment is essential to accuracy. Elaborate cost statements and calculations avail nothing unless these plant accounts are based on reliable measurements.

In the apportionment of manufacturing overhead, the production center scheme has proved successful in chemical manufacturing. That is, total overhead is divided into two parts (1) departmental overhead, and (2) production center overhead. Departmental overhead comprises the usual items of indirect material, indirect labor, service charges, and general fixed charges, and is distributed to the product in proportion to the item direct labor-hours. Production center overhead, which is superimposed on departmental overhead, is based on unit process equipment such as a filter station, evap-

orator house, or set of grinding mills, and comprises fixed charges, power to operate, and maintenance for that group only.

Another problem typical of the chemical industries is that of joint-product accounting, in which the total production cost must be distributed rationally over the two or more marketable products. Two general methods of distribution have been successful. In the first method, which is applicable generally to joint products, each product bears a cost in direct proportion to its average market value over the accounting period. In the second method, which is designed particularly for the costing of byproducts, which is simply a special case of joint-product accounting, the principal product is credited at a standard rate based either on an arbitrary proportion of *raw material* cost or on an average market value of the byproduct. From time to time, this standard rate can be changed to meet variations in market conditions.

Financial Characteristics.—Every manufacturing enterprise faces the risks attendant upon unfavorable changes in (1) raw material supply, (2) demand for product, and (3) methods of manufacture. Chemical industry is probably no exception in regard to the first and second of these risks; but in the third, there is an element of relatively great uncertainty. New methods, even utilizing different raw materials, may alter suddenly the economics of existing processes. Recent examples of such revolutionary changes are synthetic methanol, synthetic camphor and synthetic anhydrous ammonia. A classic example was synthetic indigo, which shortly after its appearance 30 years ago crushed the natural indigo trade. Internal financial policy therefore must be ultra-conservative. Rate of return on invested capital should be commensurate with the risks involved, and liberal reserves for depreciation of equipment should be provided for the day when the plant might quite unexpectedly face the necessity of liquidation. For example, at the present time all signs point to a forced retrenchment of the wood distillation industry, as imports and domestic production of synthetic methanol, acetic acid and acetone will combine to capture the market. It is true that this change will take several years, but in that short time a goodly number of the wood distillers will probably divert their capital—whatever portion can be salvaged—to other enterprises. A few complementary plants, those linked with lumbering and other of the forest products milling industries, will remain in the rôle of byproduct utilization, and thus survive.

On the other hand, the very causes contributary to risk create unusually profitable outlets for capital—witness for example, the enormous expansion of the domestic rayon industry from about $16,000,000 (price corrected to 1925 level) in 1919 to more than $100,000,000 output during 1925. No less striking is the sudden industrial rise of synthetic resins, pyroxylin lacquers and nitrogen fixation. But rapid expansion has not been confined to these newer industries, which are virtually products of scientific research. Three of the largest industries in the chemical engineering group, petroleum refining, rubber and coke byproducts, now represent 5.4 per cent of the value of all manufactured products, and have grown nearly 10-fold in 20 years. As to return on invested capital, 20 per cent is undoubtedly a fair rate for chemical industries, although 12 to 15 per cent is hardly ever exceeded by the more stable ones. Whereas a consistent return of 12 per cent might be deemed satisfactory in sulphuric acid manufacture, double that should be earned by a newer industry, such as synthetic camphor, which although important, is neither as basic economically nor as stable technically.

Enough has been said to show that the technologist and the investment banker should have a mutual and thorough appreciation of their functions in industrial development—much more so than is necessary in other types of manufacturing enterprise in which future trends are comparatively superficial. Unfortunately, however, this important characteristic, which might be termed the relation of technical development to financial policy, is not generally appreciated among bankers. Particularly in connection with the technical development of a new process is an intelligent financial policy essential. It took Baeyer and his staff 17 years (from 1880 to 1897) to perfect a satisfactory commercial process for synthetic indigo, and the development cost was said to have been $5,000,000. This is an extreme example, but it is probable that under the most favorable conditions, no major chemical process comes into successful production without several years of intensive technical development, the final stages of which invariably are costly. This indicates that in general, only the strong company, possessed of an adequate surplus, and with an established producing and marketing organization, should attempt the exploitation of new and untried chemical processes. The odds are greatly against a new organization being able to stand the required pre-production expense, particularly if the process be intricate. The advice of Charles B. Barton, a pioneer in the electrolytic alkali-chlorine industry, is well worth remembering:

> The history of the development of the diaphragm electrolytic cell emphasizes the well-known point that new processes are best developed by well organized corporations, engaged primarily in some other business that can bear the financial burden of experimental failures and keep on until success crowns their efforts.

An important index to financial health in the chemical industries is the ratio of capital invested to value of products. This factor, capital ratio, is characteristically high for the chemical engineering group, as can be seen from Table III. The average for the group is about 1.0, whereas the average for all manufacturing industries is 0.71. Although a few of the chemical industries approximate the latter figure, most of them are definitely higher, thus indicating the relative significance of capital assets, and hence of fixed charges, in this industrial group. It is obvious that in order to minimize fixed charges per unit of product, the chemical industries must operate at full capacity nearly all the time, and that profits must be taken from a large volume of production, thus necessitating large economic units, such as are characteristic of petroleum refining, sugar refining and iron smelting.

Table III—Ratio of Capital Invested to Value of Products, Calculated from the Census of Manufactures, 1919

Industry	Capital Ratio	Industry	Capital Ratio
Acids and other chemicals	1.17	Manufactured gas	4.45
Cement	1.55	Paint and varnish	0.70
Clay products	1.49	Paper and wood pulp	1.16
Coke byproducts	1.15	Petroleum refining	0.72
Fertilisers	1.11	Rubber industries	0.84
Glass	0.82	Soap	0.67
Iron smelting	1.01	Sugar industries	0.51
Leather tanning	0.72	Average, all mfg. industries	0.71

On the Engineer's Book Shelf

A New Approach to Chemical Theory

FUNDAMENTALS OF PHYSICAL CHEMISTRY. By Professor *A. Eucken*, translated and adapted from the second German edition by *Eric R. Jette* and *Victor K. LaMer*, assistant professors in the Department of Chemistry, Columbia University. McGraw-Hill Book Company, New York. 699 + pp. Price $5.50.

Reviewed by Hugh S. Taylor

Drs. Jette and LaMer have brought a goodly German prize into port, have refurnished it to suit American purposes, and have added to its equipment important weapons of attack on the problems of physical chemistry which yet await solution. The classical treatment of physical chemistry has here disappeared. In its place is a triple consideration of fundamentals, from the standpoints of thermodynamics, kinetic theory and quantum theory (where such is possible). No occasion has been taken to avoid the use of mathematics; on the contrary it is pointed out, as cannot too often be emphasized, that the amount of pure mathematics required is in reality quite small and that it is in the applications, the interpretation of formulas, that difficulties arise. A special introduction dealing with this aspect has therefore been supplied, *i.e.*, Sec. A, pp. 1-30.

It is in Sec. B that the divergence from the classical text reveals itself quite pronouncedly. A unified method of treatment is adopted. After a general discussion of thermodynamic and kinetic methods, these methods are severally applied to each of the states of aggregation, to solutions and polycomponent systems.

Sec. C, on chemical thermodynamics, including electrochemistry, deals in reality with chemical equilibrium, kinetic and thermodynamic, between molecules and between ions and with chemical reaction velocity. This latter sub-section is probably the poorest in the whole book and demands the same processes of expansion that the translators gave to solutions and Dr. LaMer to equilibrium in electrolytic solutions. Fifteen pages only is given to homogeneous reaction velocities including general theory, and the effects of temperature and catalysts. Heterogeneous systems are dismissed in 3½ pp. of which 2 pp. is taken up with the alleged predominant influence of diffusion velocity. Even the German researches conducted by Bodenstein in this field are not mentioned. Ionic mobilities and transport, overvoltage and passivity are included in the remainder of the section on velocity.

Sec. D is a brilliant exposition in 200 pp., of the structure of matter. It is outstandingly the best exposition of the subject for the chemist's purposes that the reviewer has yet seen. It is a section which every teacher of physical chemistry would do well to read and ponder, to estimate how far his courses are keeping abreast of the majestic pace of modern discovery.

In several portions of the book the reviewer finds himself in disagreement with the author. The section on theories of adsorption, Sec. 172, needs complete rewriting, especially the second paragraph. Reversible adsorption of gases involving 30,000 calories of heat energy can scarcely be said to involve "obviously . . . weak forces." The lead chamber process, p. 436, is not so easily explained nor does it seem likely that either of the two possibilities, p. 437, for the catalytic action of water on the burning of carbon monoxide in any way represent the true function of the water vapor. Eucken states definitely, pp. 437-438, that the reason for the platinum catalysis of hydrogen-oxygen gas is that the reactants are in the atomic condition on the metal.

The translators have done their work well. They have placed English readers under a great debt of obligation by their amplification of the text, in reference to solutions, making available a most up-to-date treatment of "activity" and the Debye-Häckel theory of electrolytic solutions. The reviewer would suggest "isolated" for "closed" on p. 43, line 22, "in" for "into" on p. 64, line 9. The last sentence of Sec. 22, p. 45, and that in the first paragraph of Sec. 167, p. 267, could be more happily expressed; also, the last sentence in the footnote at the bottom of p. 382. Is it correct to state that metal atoms "possess a strong tendency to dissociate off electrons" and is not the infinitive verb rather clumsy? Bodenstein is spelled wrongly in the author index. Is hydrogenation really irreversible, p. 395, in the case of the ethylene-hydrogen-ethane reaction, or do side reactions alone prevent its realization?

The reviewer expresses his sympathies to the translators in the thorny problem of symbols and nomenclature. Now that the nations are getting together once more, cannot this problem and uniform abbreviations for chemical literature be finally and satisfactorily solved? In the meantime ψ, F, f, A, $-A_T$ and $-A_{T,v}$ remain as eloquent symbols of disunion and of maximum work in a two-fold sense.

Anyone who wishes for a fresh, original, and, in most respects, up-to-date treatment of modern physical chemistry in its fundamental aspects can find it in this book, well printed, well published, at a reasonable price.

Pointing the Way to the Future of Coal Carbonization

LOW TEMPERATURE CARBONIZATION. By *S. N. Wellington*, A.M.I. E.E., and *W. R. Cooper*, A.I.C. J. B. Lippincott Company, Philadelphia. 238 pp. Price $9.50.

Reviewed by G. L. Montgomery

The literature of coal carbonization has grown apace these last few years and in this growth much emphasis has been laid upon low temperature carbonization. This has seemed to be in direct response to a popular demand, for interest in the subject has been so great that there seems to be almost as many would-be inventors in this field as there are potential scenario writers in another field.

Perhaps for this reason, most of the volumes issued up to now on low temperature carbonization have dealt mostly with the design of the various systems and to some extent also with the operation of these systems.

There has been a dearth of literature dealing with the fundamentals of the subject, that is, the theory underlying the operation of any low temperature carbonizing system. There has also been little attempt made to show how the products of a successful system would be used, if at all.

It is because of these facts in particular that one welcomes the publication of "Low Temperature Carbonization" by Wellington and Cooper. These authors have made a beginning of the study of the theoretical and economic side of the subject in their work. Chapters on the nature of coal and upon what actually happens in the laboratory and in the plant during carbonization, together with a discussion of the relation of coal thickness to gas evolution and of the products of the process at different temperature serve to give the student a fair background of fundamentals upon which to base his further study. It is to be hoped that sometime a work will be published covering this side of low temperature carbonization thoroughly.

In addition to the above welcome addition to the text of this book, a section is given reviewing in some detail the results of recent research in coal carbonization and with the products of carbonization. This section points the way to the economics of the process and in conclusion the authors offer an analysis of central station generation of electric current, showing how low temperature carbonization may fit into that industry in an economical manner sometime in the future when a perfected process is available.

In conclusion, the authors are to be complimented in producing a work of real value to their field, one which is a distinct advance over previous publication and which cannot fail to be stimulating to the many engineers whose thoughts are now engaged with low temperature carbonization.

Rogers' Industrial Chemistry Revised

MANUAL OF INDUSTRIAL CHEMISTRY. Edited by *Allen Rogers*, head of department of industrial chemistry, Pratt Institute. D. Van Nostrand Company, New York. 1267 pp. Price $10.

The fourth edition of Rogers' excellent book on industrial chemistry needs but little comment. The editor and his 34 collaborators have thoroughly modernized the text, which should continue to occupy its much respected place in the chemical literature. A possible criticism is that the book lacks a sense of space proportion. For example, iron and steel and petroleum refining are by far the leading industries of the group and yet they are allotted but 15 and 36 pp. respectively, in a total of 1,267 pp. On the other hand, essential oils and synthetics have 42 pp. and leather, 80 pp., or about one-tenth of the whole book.

The division of the text into 2 volumes is a decided improvement over the single volumes of previous editions.

Chemistry for the Layman

CHEMISTRY IN INDUSTRY, Vol. II. Edited by *H. E. Howe*, editor, *Industrial and Engineering Chemistry*. The Chemical Foundation, Inc., New York. 392 pp. Price $1.

The second volume of "Chemistry in Industry" deserves all the praise accorded its companion, which already has passed the 30,000 mark. It goes without saying that such a book should be interesting, and to make it at once interesting, instructive and accurate is the difficult task that has been accomplished by the editor and the 22 contributors. Ellwood Hendrick's chapter on "Catalysis—A New Factor in Industry," should be read by every business man in America, and especially by those who complain of hard times. It carries the moral, inimitably expressed, that chemistry is the catalyst of business.

Distillation in Practice

DISTILLATION IN PRACTICE. By *C. Elliott*, A.M.I.C.E., A.M.I.M.E. D. Van Nostrand Company, New York. 188 pp. Price $3.

Reviewed by W. L. McCabe

This volume is a companion work to the author's "Distillation Principles." The first few chapters are devoted to the theory of simple distillation, fractionation (both continuous and discontinuous) and fractional condensation. The explanation of counter-current rectification based on the boiling point composition curve is excellent. The treatment of rectifying column calculations follows very closely that of E. H. Leslie's "Motor Fuels." However, it would have been well to point out that unless the number of perfect sections is quite large it is better to carry out the calculations from plate to plate in a stepwise manner rather than go through a long graphical integration.

A short chapter on heat transfer follows the theoretical chapters. In general the treatment is sound, but is not completely up-to-date in some of the film coefficient formulas, such as that developed by McAdams and Frost for the film coefficient of heat transfer from non-boiling liquids to metal.

The practice of distillation is well represented in the remaining chapters of the book, wherein are covered the subjects of distillation apparatus, including stills, columns, condensers, coolers, and heat interchangers, and of distillation practice in the fields of ethyl alcohol, petroleum and coal tar refining.

THE STATES OF AGGREGATION. By *Gustav Tammann*, director of the Institute for Physical Chemistry at the University of Göttingen. Authorized translation from the second German edition by *Robert Franklin Mehl*, National Research Fellow. D. Van Nostrand Company, New York. 297 pp. Price $5.

It is hardly necessary to emphasize the profound effect of the physical chemistry of solids upon industrial processes and technique. Therein lies the very fundamentals of the glass, ceramics, enameling, plastics, and much of metal working. And yet the changes in state from the vitreous amorphous to the liquid and crystalline have remained only partly understood until recently. Probably no one is better qualified to write on equilibria in one-component systems than Professor Tammann, and it is felt that his work, so ably translated by Dr. Mehl, will find an enthusiastic reception in this country.

AN INTERMEDIATE TEXTBOOK OF PHYSIOLOGICAL CHEMISTRY WITH EXPERIMENTS. By *C. J. V. Pettibone*, associate professor of physiological chemistry, medical school, University of Minnesota. The C. V. Mosby Company, St. Louis. 404 pp. Price $3.25.

This is the third edition, carefully revised and considerably enlarged, of the author's excellent book on the biochemical aspects of physiological chemistry, first published in 1917.

THE CREATIVE SPIRIT—AN INQUIRY INTO AMERICAN LIFE. By *Rollo Walter Brown*. Harper & Bros., New York. 233 pp. Price $2.50.

A philosophic study into the pioneering, or creative spirit of the American people has been made by the author, who is an educator of broad experience.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Esthonia for Admission of Germany to International Union

To the Editor of Chem. & Met.:

Sir—I beg the opportunity to correct an error in my account in your August issue of the Sixth Annual Congress of Pure and Applied Chemistry at Bucharest. I stated that "Belgium, France, Poland, Esthonia, Czecho-Slovakia and Jugo-Slavia found themselves quite unable to forgive German war actions" and hence opposed the admission of Germany to the Union. I now have a letter from Professor Dr. F. Dreyer of the Esthonian University at Reval, who has read my article in translation in the *Chemiker Zeitung*. He writes as follows:

As you may recall I took no part whatever in the discussion. When the question came to a vote I voted for the change of statutes (thus to admit the Central Powers); indeed, I did so twice. When the secretary called for Esthonia's vote I shouted "Pour" (For). However, one of the gentlemen, a Belgian I believe, presumably had not heard me and shouted "Contre" (Against); I then shouted again "Je suis d'accord" (I am for it).

Furthermore, in the meeting of the council I gave the general secretary just before the voting a written communication that I had been authorized by my government to vote for the change in statutes as proposed at Copenhagen.

F. DREYER.

I regret to have misrepresented the Esthonian position and shall appreciate the opportunity for public correction.

GERALD L. WENDT.

State College, Pa.

Properties of Refractory Space Heaters

To the Editor of Chem. & Met.:

Sir—In the article entitled "Types of Electrical Heating Appliances For Industrial Use" by Robert M. Keeney, the author describes various forms of heating units and does not say they represent the standards employed by his Company. On p. 857 he makes a statement that the immersion heater may burn out under certain conditions, among them, that 15 to 90 lb. pressure is too high. This may be true for the units manufactured by the author's Company, but as he is undertaking to advise prospective users of the characteristics of heaters, we do not think he is justified in publishing such statements without being more specific.

On p. 859 he makes a misstatement with regard to refractory insulated strip units or space heaters. He says that a space heater with refractory insulating material instead of mica, will operate satisfactory to a temperature of 1,000 deg. F., but it cannot be bent. This is not a complete statement of the condition of the art. Space and strip heaters are being made with refractory material capable of standing 1,500 deg. F., and they can be bent into complete circles, as small as 5½ in. diameter. We have had some units in use, which have been bent into complete circles working at 1,500 to 1,600 deg. F., for over 12 months, and there is no reason to suppose that they will not give years of satisfactory service.

It may also be timely to point out that refractory strip heating units are being supplied on the Illinois Central Railroad, electrification for heating the cars, to operate on 1,500 volts direct, the heaters being connected in series, and can be supplied to operate on higher voltage if necessary.

We should also like to remark that this same make of strips has opened up a new field in regard to possible uses due to their ability to stand abuse from overload and temperature rise.

These remarks are prompted, not by the desire to exaggerate the ability of electrical heating units to stand up, but to show what is being accomplished by some manufacturers in this field of work.

Philadelphia, Pa. HAROLD E. TRENT.

Coal Tar Utilization

To the Editor of Chem. & Met.:

Sir—In my article on the "Relation of Tar Utilization to Coal Carbonization," which appeared on pp. 869 and 870 of your November issue, there was an unfortunate transposition of words that gave an incorrect meaning to one of my statements. Referring to the two most fully developed projects in which domestic fuel is the prime object, the article, as printed, states: "Both of them produce tar in large volume which at the present time, is practically unmarketable except at fuel oil value." As originally written this sentence read: "Both of them produce tar, which in large volume is practically unmarketable except at fuel oil value at the present time."

You will appreciate, I am sure, that there is a considerable difference in the meaning of the two sentences.

S. R. CHURCH.

New York City.

Refrigeration Data Compiled by Bureau of Standards

The properties of the brines used in refrigerating plants have been collected and correlated by the Bureau of Standards, for publication in the International Critical Tables, now being prepared by the National Research Council. The properties of brines are of use to the engineer in designing or testing a refrigerating plant and are four in number: (1) density, (2) specific heat, (3) viscosity, and (4) freezing point.

In a refrigerating plant, heat is transferred from the objects to be refrigerated, to the cooling coils by which it is absorbed. In an ice making plant, for instance, heat must be transferred from the water which is to be frozen to the cooling coils. This is usually accomplished by immersing both the cooling coils and the ice cans in a liquid of low freezing point, and circulating the liquid so that it flows over the expansion coils and around the ice cans. The liquids ordinarily used for this purpose are aqueous solutions of various salts, among which are sodium chloride, calcium chloride, and magnesium chloride. Heretofore, no attempt has been made to so thoroughly correlate these useful data.

Recent Articles in Technical Periodical Literature

Coal Gas. A study of the volatile constituents given off by partly coked coal at different temperatures. H. Tropsch and E. Dittrich, *Brennstoff-Chem.*, vol. 6, No. 19, p. 301.

Water Gas. Optimum conditions have been determined and cost calculations made for using oxygen in manufacturing water gas. F. E. Vandaveer and S. W. Parr, *Ind. & Eng. Chem.*, vol. 17, No. 11, p. 1123.

Steam Accumulators. Operating principles and importance to industry are given. A. J. T. Taylor, *Combustion*, vol. 13, No. 5, p. 275.

Motor Fuel. Discussion of present and future supply of petroleum motor fuel and its conservation, the latter being largely up to the consumer. K. G. Mackenzie, *Ind. & Eng. Chem.*, vol. 17, No. 11, p. 1105.

Synthetic Liquid Fuels. Review of various processes for production of liquid fuels from coal. A. P. Sachs, *Combustion*, vol. 8, No. 6, p. 358.

Fertilizer Industry. Progress of the fertilizer industry in the years 1921-1924. G. Wichern, *Chem. Zeit.*, vol. 49, No. 125, p. 885.

Drying Oils. Chemistry of drying oils, continued. G. W. Ellis, *J. Soc. Chem. Ind.*, vol. 44, No. 40, p. 469T.

Casein. Casein and its industrial applications. Anon., *Chem. & Ind.*, vol. 44, No. 42, p. 1009.

Phosphates. Discussion of the solubility, decomposition and uses of the different forms of phosphoric acid and fertilizer materials containing phosphates. K. Scharrer and A. Strobel, *Zeit. Angew. Chem.*, vol. 38, No. 43, p. 953.

Nitrates. Growth and present status of the Chilean nitrate industry is outlined. P. Krassa, *Zeit. Angew. Chem.*, vol. 38, No. 41, p. 921.

Hydrogenation. Catalytic hydrogenation under reduced pressure. R. Escourrou, *Chim. et ind.*, vol. 14, No. 4, p. 519.

Cellulose. Thermal decomposition of cellulose under hydrogenation conditions. A. R. Bowen, N. G. Shotwell, and A. W. Nash, *J. Soc. Chem. Ind.*, vol. 44, No. 45. p. 507T.

Molasses Residues. Process and equipment are described for the production of potash, sodium cyanide and ammonia from the destructive distillation of molasses residues. F. Muhlert, *Chem. Apparatur*, vol. 12, No. 21, p. 211.

Electrochemistry. Progress of technical electrochemistry in the last decade. F. Müller, *Zeit. Angew. Chem.*, vol. 38, No. 42, p. 933.

Automatic Feed. Description of automatic device for feeding liquids at a constant rate. An application in the manufacture of saccharine is given. *Chem. Zeit.*, vol. 49, No. 124, p. 877.

Government Publications

Flotation Reports: Bureau of Mines Serial No. 2694, Present Trend in Flotation Flow-Sheets and Classification of Flotation Feed by A. W. Fahrenwald; Serial No. 2698, Barium Polysulphide in Sulphidizing Oxide Ores for Flotation, by E. S. Leaver and H. M. Lawrence; Serial No. 2700, Present Status of Differential Flotation, by A. W. Fahrenwald.

Metallurgy of Quicksilver by O. C. Ralston. Bureau of Mines Bulletin No. 222.

The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and in Air by R. R. Sayers and W. P. Yant. Bureau of Mines Technical Paper 373.

Manufacturing Statistics—Census of Manufactures, 1923, separates now available for the following commodities: Petroleum; Cement, Lime and Sand-Lime Brick; Silk; Paper and Wood Pulp; Clay-Products; Explosives; Soap; Slaughtering and Meat Packing; Salt; Manufactured Ice; Wood Distillation and Charcoal; The Drug Industries; Fertilizers; Electrical Machinery Apparatus, and Supplies; Corn Sirup, Corn Oil and Starch.

Glue and Edible Gelatin statistics for the second quarter of 1925 available in preliminary press statements from the Census of Manufactures. Similar statistics for animal and vegetable fats and oils for the calendar years of 1923-24 in printed form.

World Trade in Gasoline with supplementary report on alcohol motor fuels, by Homer K. Fox. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 20.

Domestic Market Possibilities for Sales of Paints and Varnishes by George H. Priest, Jr. Domestic Commerce Series No. 2 of the Bureau of Foreign and Domestic Commerce.

Emulsions of Wormseed Oil and of Carbon Disulphide, Department of Agriculture Bulletin 1332.

Abbreviations Employed in Experiment Station Record for Titles of Periodicals. Department of Agriculture Bulletin 1330.

Carbon Disulphide as Insecticide, Department of Agriculture Farmers' Bulletin 799.

Commercial Bordeaux Mixtures, how to calculate their value. Department of Agriculture Farmers' Bulletin 994.

Navy Metal Specifications including the following: 17A4a, "Anodes, Nickel"; 46A2, "Aluminum, Ingot"; 52A1c, "Aluminum, Powdered"; 46B19a, "Bronze, Aluminum (Composition Al-i), Ingot"; 46B11d, "Brass, Commercial (Composition B-c); Castings"; 46B10d, "Brass, Naval (Composition N-c): Castings"; 51C14, "Compounds, Carburizing"; 47Li, "Lead, Sheet"; 46S1e, "Steel; Shapes and Bars for Hull Construction, Including Material for Drop and Miscellaneous Forgings"; 49S1g, "Steel; Castings."

Welding Materials Specifications of the Navy, as follows: 51F2 Fluxes, Welding; 46R1, Rods, Welding, Non-Ferrous, for Gas Welding; 45R1, Regulators for Acetylene, Hydrogen, and Oxygen Gases.

Calcium Carbide, Specifications of the Navy Department, No. 51C 13a.

Carbon Electrode Specifications, Navy Department, No. 17E2 for amorphous carbon electrodes for electric steel melting furnaces.

The Story of the Production and Uses of Ductile Tantalum, by Clarence W. Balke. Smithsonian Publication 2766.

Atmospheric Nitrogen Fixation, by Eric A. Lof. Smithsonian Publication 2764.

Industrial Dust Problem, III.—Comparative Field Studies of the Palmer Apparatus, the Konimeter, and the Impinger Methods for Sampling Aerial Dust, by L. Greenberg, Public Health Reports, No. 31, issued July 31, 1925.

Census of Dyes and Other Synthetic Organic Chemicals, 1924. Tariff Commission, Tariff Information Series No. 33.

Flow in a Low-Carbon Steel at Various Temperatures by H. J. French and W. A. Tucker. Bureau of Standards Technologic Paper 296.

Alternating Current Distribution in Cylindrical Conductors by Chester Snow. Bureau of Standards Scientific Paper 509.

A Non-Intermittent Sensitometer (Time-Scale Exposure Machine) with Clock-Controlled Motor Drive by Raymond Davis. Bureau of Standards Scientific Paper 511.

Consumption of Reagents Used in Flotation by Thomas Varley. Bureau of Mines Serial No. 2709.

Calcium-Sulphate Retarders for Portland Cement by Ernest E. Berger. Bureau of Mines Serial No. 2705.

Temperature Control System for Dressing and Tempering Fishtail Bits by C. H. Shapiro. Bureau of Mines Serial No. 2712.

Oxygen Instruments by F. L. Hunt. National Advisory Committee for Aeronautics Report No. 130.

Commercial Dehydration of Fruits and Vegetables by P. F. Nichols, Ray Powers, C. R. Gross and W. A. Noel. Department of Agriculture Department Bulletin No. 1335.

Agriculture Year Book. Statistical volume summarizing 1924 conditions, 1250 pages. Available only through members of Congress or by purchase at $1.50 per copy, cloth bound.

Graphite in 1924 by Jefferson Middleton. Bureau of Mines statistical statement.

Manufacturing Statistics for 1923. Production report by Census of Manufactures giving final summaries, available for the following industries: Iron and Steel, Blast Furnaces, Steel Works and Rolling Mills, Wire, Tin Plate and Terneplate; Miscellaneous Fiber and Textile Products; Brass, Bronze, and other Non-ferrous Alloys and Manufacture of These Alloys and of Copper; The Rubber Industries; The Sugar Industries; Cast-Iron Pipe; The Gas and Coke Industries.

Guide to Original Sources for the Major Statistical Activities of the United States Government. Unnumbered pamphlet U. S. Bureau of Efficiency.

General Information for Refiners of Petroleum Regarding Tests of Lubricating Oils at the Engineering Experiment Station, Annapolis, Md. Unnumbered pamphlet Bureau of Engineering, Navy Department.

Publications of U. S. Geological Survey. Revised list of documents, as of July, 1925.

The Plant Notebook

An Exchange for Operating Men

Avoiding Static Discharges In a Lacquer Plant

In the handling of volatile solvents in such operations as are involved in the manufacture of pyroxylin lacquers, many precautions are observed to prevent the ignition of flammable vapors. Static electricity, in particular, has been the cause of mysterious fires and explosions that might have been avoided had careful attention been given to the grounding of equipment as a means of dispersing the static that accumulates in pipe lines, and on belts and driving mechanism of agitators and mixers.

Fig. 1 shows an effective means employed at the plant of the Beckwith-Chandler Co., Newark, N. J., for preventing the accumulation of static on the belts that drive the Pfauder pyroxylin mixers. The wooden frame, supported from an overhead beam, has attached to it two squares of ordinary copper screen wire that are held in contact with the moving belt and grounded by means of copper wires connecting them with the sprinkler system. The screen wire is sufficiently flexible to maintain a continuous contact with the belt without exerting a pressure that would cause excessive wear.

The electrostatic capacity of the workmen in the plant who are handling the solvents makes it desirable to provide means that will prevent sparks jumping from their bodies to the metallic conductors with which they may come into contact. Accordingly at this plant the men working at the different machines stand on properly grounded metal platforms or galvanized iron strips that are laid on the concrete floor. This precaution will be observed in Fig. 2, showing the storage racks provided for the steel barrels in which the solvents are received at the plant. These racks are covered with galvanized iron and are grounded to the steam pipes. The cans into which the solvents are withdrawn rest on metal floor strips which are also grounded.

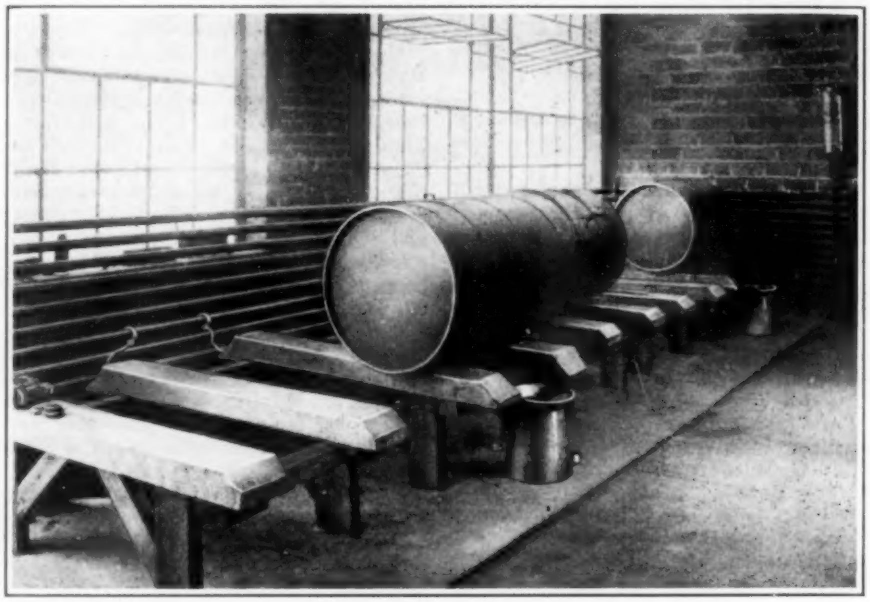


Fig. 2—Storage Rack for Holding Steel Barrels of Solvent Showing Means of Grounding in Order to Prevent Static Discharges

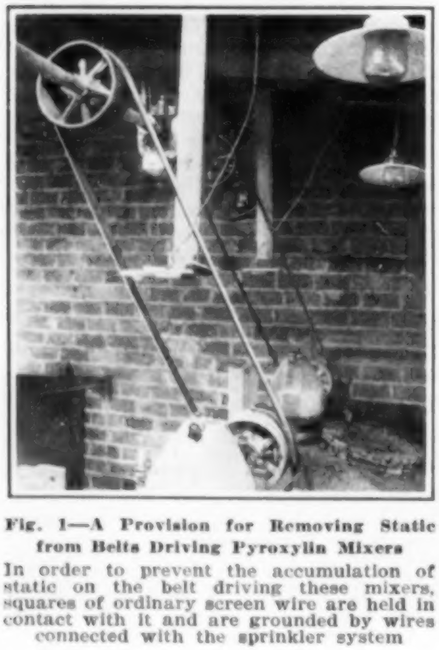


Fig. 1—A Provision for Removing Static from Belts Driving Pyroxylin Mixers

In order to prevent the accumulation of static on the belt driving these mixers, squares of ordinary screen wire are held in contact with it and are grounded by wires connected with the sprinkler system

Phosphoric Acid Tank Construction

In the Plant Notebook department of *Chem. & Met.* for August, 1925, on page 708, an item appeared concerning phosphoric acid tank construction. Since publication, we learn that there was an error in the type of mortar recommended. Actually, the work at the Bureau of Soils was laid up with a mortar made from sodium silicate and powdered quartz. It was found that this mortar gave the most satisfactory bond for the vitrified shale brick.

Spotting Air Line Leaks Under Floors

In one of the largest chemical laboratories in the country, a severe leak developed in the compressed air line. Ordinary inspection of the equipment failed to disclose the source of trouble, as the pipes were imbedded in the concrete floor structure. However, by the simple device of feeding a small quantity of amyl acetate into the compressor, the approximate location of the break was easily found and it was at once possible to make suitable repairs without cutting through much concrete.

In the case of small leaks, it is recommended that after the approximate location of the leak has been found by means of the amyl acetate, the floor in the vicinity be flooded with water or soap solution by means of which it is easy to ascertain the exact spot.

Incidentally, it might be pointed out that the placing of air or of other supply lines in concrete flooring is mighty poor engineering practice.

Refractometer for Checking Gravity of Pan Avaporation Product

At the Centerville (Calif.) plant of the F. E. Booth Co. a double-effect Peebles vacuum-pan evaporator is used to dehydrate screened tomato pulp, the product being sold in cans as tomato paste. Operations are conducted by the batch method; and a rapid estimate of specific gravity of the pulp is essential, so that evaporation can be stopped when but not before the predetermined density has been reached. Ordinary methods of determination having proved unsatisfactory, a refractometer is now used for this purpose; and a test that takes only a few seconds is alone necessary to determine the refractive index of a pulp layer of definite thickness, from which the specific gravity can be estimated by means of a table of relative values.

The apparatus is kept in an electrically lighted cupboard on the operating floor of the evaporator, near the

discharge pipe from the heaters, from which the sample is taken; and is arranged at a height suitable for convenient manipulation by the operator.

Tank Level Indication By Pressure Gage

Float indicators, to show the level of liquid in a tank, are not always satisfactory; and complications arise when the operating plant is at some distance away. It is sometimes possible to use an indirect method for the estimation of tank content — by connecting an ordinary pressure gage to the discharge pipe, the resultant reading being directly proportional to the height of liquid in the pipe and tank. Reading on the gage may be checked against actual levels of liquid in the tank, and empirical data used to formulate a scale on the gage face, showing the contents of the tank in feet of depth, gallons or other unit measurement.

Continuous vs. Intermittent Methods in Foodstuffs Sterilization

Canning is a continuous operation, followed usually by intermittent sterilization in those instances where above-boiling temperatures are necessary as with vegetables and olives. Heavy steel cylinders, miscalled retorts, are filled with car loads of the cans, and subjected to a definite steam pressure for a definite time. Automatic temperature regulation may be insured by the use of an instrument which controls the steam supply. This type of sterilizer is shown to the right of the accompanying halftone.

A recently introduced continuous sterilizer is shown to the left. The cans from the sealing machine pass into a steam-tight valve and thence into the body of the sterilizer, in which a definite pressure is maintained. The travel of the cans is in spiral fashion, so that ample agitation of contents is insured. From the high-pressure sterilizer the cans pass through an exit valve to a cooler, of the same design. The advantages of continuous sterilization include economy of time, space and fuel, coupled with an ability to maintain a more accurate control of temperature.

Continuous Sterilizer in a Californian Cannery
This type of equipment economizes time, space and fuel and also allows for accurate temperature control

Extra Displacement Washes Without Solution Accumulation

A novel method of increasing the extraction of dissolved copper from oxide-sulphide ores, after leaching treatment, has been devised by G. D. Van Arsdale. After normal procedure with weak solutions and water, an extra wash is applied, the effluent from which is passed over scrap iron, the resultant liquor being re-used and the copper precipitated so long as circulation is economically advisable. The copper produced is dissolved in normal leaching liquor (ferric sulphate and sulphuric acid) and ultimately recovered in the electrolytic plant. The high-iron solution from the cementation plant is used to maintain the iron content of the normal leaching liquor. This method of washing was developed for use in connection with the treatment of Inspiration ores of a mixed character.

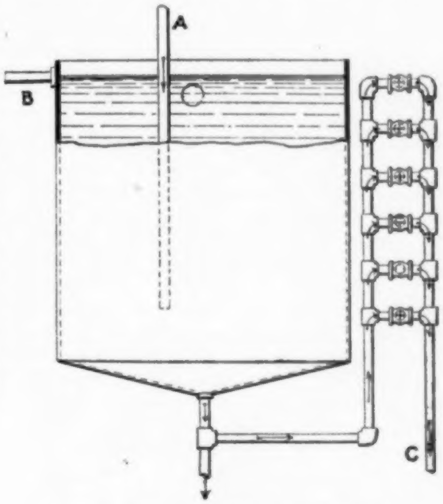
Using Woven Metal Cloth In Filter Presses

The adoption of woven metal cloth, especially of non-corrodible material such as Monel metal, as a medium in plate and frame filter presses necessitates the provision of additional packing at the edges. The Newark Wire Cloth Co. has been able to produce a satisfactory leaf, which easily withstands ordinary filling and washing pressures. It consists of a square of the metal cloth, edged with rubber, vulcanized in place. The filter leaf made by T. Shriver & Co. has an edging of cotton duck or ordinary filter cloth, which is sewn on. The impregnation of the edge of the leaf with asbestos fibre has also been suggested. A leaf of the last-mentioned type may prove especially valuable for high temperature filtration or activation work, where hot liquor or superheated steam is passed through the apparatus.

Separating Liquids of Small Gravity Difference

A settling tank such as that shown in the accompanying sketch has proved to be successful in drawing off settled impurities in cases where the specific gravity of the impurities does not differ much from that of the liquid. In such cases all disturbance of the liquid must be avoided.

The principle is that of an inverted



Settling Tank for Separation
This tank permits the drawing off of one liquid from another when the difference in specific gravities is small. *A* is the liquid outlet; *B* the overflow; and *C* is the mud outlet

U-tube, one leg of which is connected to the mud outlet of the settler, the other leg to the mud piping, while the top of the tube is made to correspond to the level of the liquid in the settling tank.

The mud is then allowed to flow off under a gravity head so slight as to reduce its velocity to a minimum. The areas are made ample. In order to compensate for changes in the density of the impurities in the ascending leg of the tube, valved connections are installed between the two legs of the U-tube, as shown in the sketch. By opening any one of these valves and keeping the others closed, the tube length is varied.

Mezzanines Help to Save Floor Space

Where floor space is at a premium a needed new accessory or additional unit frequently offers a serious problem of equipment placing. Recently one plant has solved this by building a little mezzanine on which a new gas-fired water heating unit was placed near to the apparatus where the hot water was required. Thus heat losses from the hot water lines were minimized and the water heating unit was up out of the way of ordinary operations. Many other devices can doubtless be similarly placed, thus the cluttering of aisles and passages and the congestion of the principal operating equipment with accessory devices can be prevented.

Chemical Equipment at the Power Show

Control Instruments, Pulverizers, Separators and Accessories Feature Fine Exhibition of Devices of Interest to the Chemical Engineer

THE Fourth Annual Power Show or, to give it its full title, the Exposition of Power and Mechanical Engineering Equipment, was held in New York City at the Grand Central Palace from November 30 to December 5, 1925. As in former years, the emphasis was upon power plant equipment and accessories and for this reason many of the exhibits held marked interest for the chemical engineering industries.

Undoubtedly the displays of control instruments were of the greatest importance to the chemical engineer. Among these particular note was taken of the Bristol-Derr water level gage for steam boilers, made by the Bristol Company, Waterbury, Conn. This water level gage is a modified pyrometer, which measures the height of water in a water column on a boiler by means of a thermocouple. This thermocouple can be used to actuate either an indicating instrument, a recording instrument, or both. One of the advantages claimed is that the indicating instrument can be placed in plain view of the boiler-room operator instead of being at the usual inconvenient place in which a water column is found. The recording instrument can be placed in the office or other desired point in the plant, far from the actual location of the boiler. This instrument should have other useful applications in chemical engineering industries, particularly in places where it is desirable to gage the level of hot liquids in storage or other tanks or reservoirs.

Another interesting development in the line of control instruments is that shown by the Cochrane Corporation, Philadelphia, Pa. This company has combined with its well-known flowmeter, previously described in these columns, a pressure and temperature recording instrument which records these quantities on the same chart as that upon which the flow is recorded. The instrument is also provided with an indicating scale so that flow can be read directly at any instant.

The American Schaeffer & Budenberg Corporation, Brooklyn, N. Y., exhibited for the first time a new line of dial type thermometers. These thermometers are available in five ranges, up to 800 deg. F. They are provided with several designs of bulbs and with sufficient tubing to make them available for many different types of service.

Pulverizing Unit

The Riley Stoker Corporation, Worcester, Mass., displayed for the first time a new pulverizing device known as the Atritor. This is a pulverizing mill brought out primarily for the pulverizing of coal. It is, however, by its design well adapted to the disintegration and pulverizing of many other materials that are not too hard or abrasive, among these being such substances as lithopone, talc, whiting, chalk, clays, shales, pigments, asbestos, fullers earth and so on. In operation this mill is 2-stage in type and mounted on a horizontal shaft directly connected to the driving motor. The material being ground first enters an effect of the swing-hammer type. From this effect it passes into a second or disintegrating effect in which the final pulverizing is done. This second effect is made up of alternate rows of stationary and moving pegs mounted circumferentially upon a stationary and a rotating disk. The material passes from the outer circumference towards the center between these pegs. Beyond this point there is a suction fan which pulls the material through the unit and delivers the pulverized product where desired.

A device seen for the first time at this exposition which promises many interesting applications is the Vastine furnace fire observer. This device, made by the Vastine Sales Corporation, 205 West Harrison Street, Chicago, Ill., is a special type of observation window for mounting in furnace settings which permits direct and comfortable observation of what is going on inside the furnace and effectively shuts off the heat and glare from the observer.

Separating Liquids from Gases

The Centrifix Corporation, Cleveland, Ohio, exhibited an interesting new device for the separation of liquids from vapors or gases and also for separating solids from liquids. The device consists of a cylinder, the walls of which are made up of a number of blades similar in shape to those used in a steam turbine. The unseparated vapor or liquid is directed into this cylinder from the outside through these vanes at high speed. In consequence a high-speed whirling motion in the material itself is set up inside the cylinder. This in itself tends to separate the lighter from the heavier constituents and in addition by means of restricted or expanded passages through which the material is led the separation is completed. This device is at present most fully adapted to the use of power stations in separating moisture from steam, a number of applications having been made directly at the steam offtake of boilers. It is also used for separating oil from steam; for eliminating oil, moisture and grit from compressed air; for purifying the suction air of compressors, blowers and fans; for taking water, tar, soot and oil out of various gases; for removing dirt and other solids from water; for dehydrating and purifying oil; and for numerous other purposes.

The B. F. Sturtevant Company, Hyde Park, Boston, Mass., have developed in connection with their economizers for power plant use, a method of lead coating which promises an extended use in other fields as well as this one for the protection of apparatus from corrosion. This is a patented process in which a lead alloy is applied to any surfaces subjected to corrosive action. By its use it has become possible to employ steel in constructing these economizers.

Improved Flexible Coupling

Smith & Serrell, Newark, N. J., exhibited an improved type of Francke flexible coupling. This coupling is a redesign of the former heavy pattern type coupling made by this concern and retains the features of the old coupling plus several additional features said to vastly improve the device. Allowance has been made for more and easier endwise movement. The coupling is designed for the transmission of greater power and is capable of taking larger bore shafts. In this redesigned coupling graphited bronze bushings are used in the larger sizes and plain bronze bushings in the smaller sizes. The pin units are free to move a full half inch within these bushings. Contact surfaces have been more than doubled and are cylindrical in shape. All movement is between steel and bronze surfaces thus increasing the life of the coupling.

The Ruths Accumulator for steam, which has been described at length in these columns in the past, was exhibited for the first time in this country at the present show. This device has been made up to the present time in Europe and has found rather an extended use in such fields as the paper industry. It has recently been employed in Canada in connection with electric steam boilers. The use of offpeak power with these boilers makes possible the generation of steam under the most economical conditions and its storage in the accumulator for use as desired. This concern is now prepared to make this device available for American industry.

The Cooling Tower Company, Inc., 15 John Street, New York City, exhibited a new type of air filter for use in removing the dirt and other foreign matter from the air supply of fans, blowers and compressors, and for similar services. This device is called the Type A Tangldust Air Filter. The units are arranged to fill the cross-section of the air intake dust and consist of two sections, the first section is of the baffle or separator type in which the air is caused to pass through a number of baffle plates and a primary separation, which is said to take out about 70 per cent of the foreign matter, is effected. The second stage consists of a large number of wire coils through which the air is forced. The surfaces of both of these sections are kept covered with a special oil which is said to be non-evaporating and particularly suited for catching dust.

The American Machine & Foundry Company, Brooklyn, N. Y., exhibited for the first time their new high-speed rotary pump. This pump which has a horizontally driven rotor directly connected to the driving motor, operates on a principle somewhat different from that used with other rotary pumps. The rotor is a plain drum similar in form to the armature of a motor. On this drum is cut a wide helical groove. In this groove and attached to the drum casing are vanes which serve to move the liquid through the helical groove as the drum rotates.

Equipment News

From Maker and User

What Is the Editor's Responsibility to the Advertiser?

Abstract of an Address Given Before the Annual Convention of the National Industrial Advertisers Association, Atlantic City, October 19, 1925

By E. J. Mehren
Vice-President, McGraw-Hill Co., Inc.

BEFORE answering the question posed in the title of this address, we need to understand the editor's responsibility broadly. It is his job to provide the reading matter. His task is, first, to cover the field adequately so that all information of first importance gets into his pages, and, second, to build up such a reputation for the paper's integrity that the reader will persistently turn to it for information and guidance. That is the sum and substance of the responsibility of the editor.

Strictly interpreted, therefore, he has no responsibility to the advertiser. It is with the reader, not the advertiser, that he makes a covenant, when his publisher takes the subscription money, to render comprehensive and disinterested service.

But the matter cannot be so simply dismissed. True, stated in all baldness, the editor has no responsibility to the advertiser, as such. He does have, however, a responsibility to manufacturers. These manufacturers are part of the industry. They supply the material and tools with which the industry works. They are as much part and parcel of it as the consumer; without them the industry could not exist. What they do for the improvement of materials, machines, processes and services, is vital to the industry, and, therefore, to the executives and workers, who are the readers that the editor serves. It follows, then, that the editor is bound, in order that he may interpret to the reader the developments and progress made in the manufacturing end of the industry, to keep close to the manufacturers and to record the progress they are making.

But that responsibility is to the manufacturers as a whole. The manufacturer who chooses to advertise does not thereby acquire a claim to reading space over and above that of any other manufacturer. This is, to use the Biblical phrase, "An hard saying." It might, moreover, if read by itself, imply that the editor cares little whether people advertise in his paper or not. Such is not the case. The editor, in fact, in taking that position, protects and preserves the very value bought when advertising space is taken. What is bought is the confidence of the reader. The greater his faith in the paper, the greater the value as an advertising medium.

It necessarily follows that if the editor holds a special feeling of obligation to an advertiser because he advertises; if he would print something for the advertiser that he would not print for a non-advertiser who has an equally meritorious proposition, he would violate his covenant of honesty and truth with the subscriber. The bars once let down—the principle thrown to the winds—there is no reason why the editor, on behalf of his advertising department, should not freely trade reading space for advertising patronage.

If, then, editors and publishers jealously refuse to trade their reading pages for advertising orders, it is not because they want to erect artificial standards, or because they are out of sympathy with the efforts of a manufacturer to secure the widest possible dissemination of his story. It is because the very medium that the advertiser values would be destroyed if subserviency of the editor to the advertiser were to prevail.

How the Editor Can Help the Advertiser

The editor can help the advertiser, can help the manufacturer, should do it and is glad to do it. To begin with, the editors are helping every day in ways that are not appreciated. The live editor is constantly interpreting to the advertising manager and the advertising salesmen of his paper the conditions in his field, the methods of buying goods, the changing practices and changing demands of consumers, the type of selling appeal that is effective. This information comes to the advertiser through the indirect channel of the sales forces of the paper. But the editor is there, giving of the fullness of his knowledge of the field to help build a sound sales policy and to fit advertising into it intelligently.

The editor can help, too, in pointing out the type of reading matter which should emanate from the manufacturer's organization and which can legitimately be used in the reading pages of his publication. That has been done often by prominent editors in public pronouncements. Frank C. Wight, editor of *Engineering News-Record*, put the matter briefly in an address before the New York Editorial Conference in December, 1924. Said Mr. Wight:

"Only the first time a thing happens is it news. Any new thing is entitled to one editorial presentation. Any contribution to the industry, be it manufacturing device, change of business procedure, change in personnel of his company, new application of some of his equipment—anything which is news is entitled to the editorial space it warrants as news. After that, it is advertising.

"Every day there comes to the editor's desk some descriptive matter of a new device or detail which has already been broadcast in circulars or advertisements until its news value is lost. The advertising man thinks in terms of advertising before he thinks in terms of publicity—but he wants publicity. If he is to get it, he must remember that by its very nature it has prior right over advertising. Every dog, says the old common law, is entitled to one bite. Every novelty is entitled to one bite of free advertising."

Co-operation Must be Given by Editors

This is a sound general statement regarding news from manufacturers. But the editor has a responsibility, as well, of direct co-operation with the individual manufacturer on publicity matter.

He should point out to the manufacturer what deficiencies there may be in the material sent to him by the manufacturer. He should indicate just what sort of additional material he needs in order to make a worth-while item—one that will be helpful to the reader.

Such handling of matter received from the manufacturer is not merely the responsibility of the editor to a branch of his field; it is the responsibility of plain courtesy as well.

The Advertiser's Responsibility to the Editor

We have been discussing the editor's responsibility to the advertiser. What of the advertiser's responsibility to the editor?

Here, again, the responsibility comes not from the fact that the advertiser is an advertiser, but that he is a manufacturer. Of course, the fact that he is an advertiser indicates that he has already formed a relationship with the publication that should facilitate his contact with the editor, just as this fact should facilitate the relationship which starts from the editor and goes to the advertiser. The responsibility, then, is that of the manufacturer to the editor. And it is just here that the keenness of the advertising man should prove a valuable asset to his organization and

to the editor or publication as well.

The advertising man senses news values, the advertising values of developments made by his organization. What more natural, therefore, than that he should want to put news and data about these developments into the hands of the editor as quickly as possible. If the editor has any responsibility to the manufacturer, then the manufacturer, in turn, has the reciprocal responsibility to the editor.

These standards consistently maintained win reader confidence, and reader confidence is the forerunner and creator of an effective advertising medium. If this sequence—high editorial standards, creating reader confidence, and reader confidence creating advertising value—be understood, the unity of interest between editor and advertiser will be appreciated and there will be left no ground for misunderstanding between them.

Hydrogen Ion Equipment

The LaMotte Chemical Products Company, 416 Light Street, Baltimore, Maryland, has recently put on the market their improved LaMotte Hydrogen Ion Comparator Set, for accurate determination of Hydrogen Ion Concentration. This set consists of a combined comparator box and tube rack which contains one complete set of color standards, such as bromthymol blue pH 6.0-7.6, in intervals of 0.2 pH; two tubes of indicator solution, one of which is fitted with a 0.5ml. pipette and nipple; and three 10ml. test tubes.

The set is used for determining the active acidity of all liquids and solutions and is particularly applicable to sugar refining, electroplating, tanning, rubber, gelatin, glue, dyestuffs and general chemical manufacture, etc. For clear and colorless solutions, 0.5ml. of the indicator solution is added to 10ml. of the material to be tested, and the color produced is matched directly with the standards, from which the pH value can be read off. With colored and turbid solutions, a color screen is formed by a special arrangement of the tubes, so that the effect of color and turbidity in the sample are eliminated and results accurate to 0.1 pH can easily be obtained.

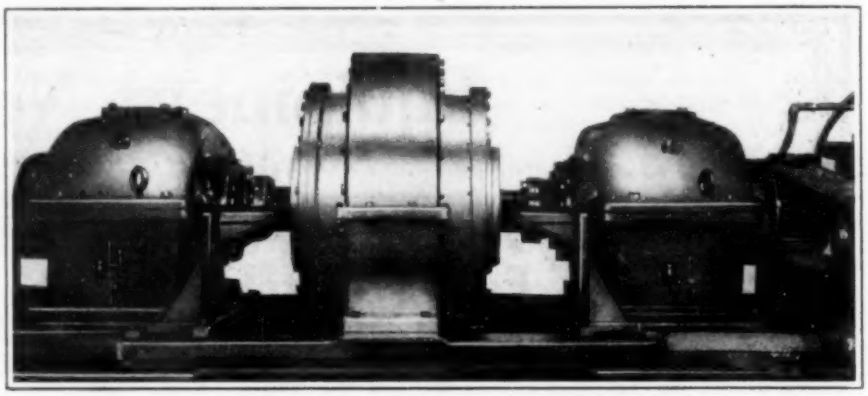


Fig. 1—The Laughlin Continuous Centrifugal Filter

Centrifugal Filter

A centrifugal machine for separating solids from liquids, mentioned in *Chem. & Met.'s* report of the Tenth National Exposition of the Chemical Industries, in the October, 1925, issue, has recently been placed on the market by the Laughlin Filter Corporation, 120 Broadway, New York, N. Y.

This machine, shown in Fig. 1, is a small, self-contained unit. It is centrifugal in action, operating at comparatively low speeds. The filtering action is continuous. No filter cloths, screens, or filtering mediums are necessary.

Fig. 3—Main Rotating Element of Continuous Centrifugal Filter

The scraper arms used for removing the solid material are here shown pulled forward on the shaft from their correct position.

Fig. 2 shows a cross-section of the machine. Referring to this figure, the mixture to be filtered is fed in through the hollow shaft *A*, from which it passes to the annular chamber *B* by centrifugal force. The machine element *J* in which this chamber *B* is situated, shown in Fig. 3, together with the coverplates which are not shown in the figure, revolve with the shaft, to which they are affixed. This revolution throws the mixture out through the holes shown into passage *C* and hence against the annular surface *D*.

As the centrifugal force packs the mixture against the peripheral surface *D*, the liquid is forced out and drops back through *C*. The rotation causes it to pass into the chamber *G*, from whence it is discharged into the stationary liquid discharge chamber *H*, which is an annular casting in two parts, as shown in Fig. 4.

The solid matter is scraped from the peripheral surface *D* by the arms shown in Fig. 3 and shown in more detail in Fig. 5. These scraper arms revolve in the chamber *E*, with the main machine element, but at a slightly different speed, so that they make several complete revolutions per minute with reference to the surface *D*. The solid matter is guided by these arms toward the center and discharged through the opening *F*.

The machine is particularly adapted for use with sand slimes, flotation concentrates, powdered coal, or any crystalline, fibrous or granular material that readily separates upon standing from the liquid with which it is mixed. With such materials a complete separation can be obtained. Where a large amount of comparatively dry solids are desired, the filter should follow a thickener. In this case, the liquid discharged from the filter is returned to the thickener for clarification. When handling materials of a colloidal nature, the addition of some granular element is an aid. The larger the amount of

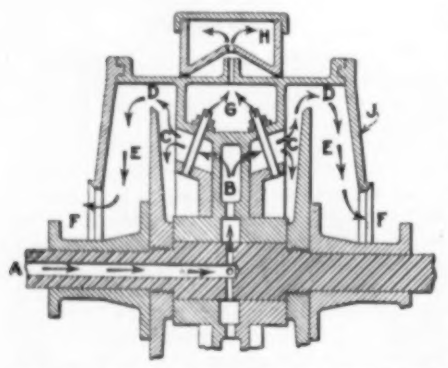


Fig. 2—Cross-Section Through Continuous Centrifugal Filter

As detailed in the accompanying article, the mixture of liquid and solid enters at *A*, the liquids being discharged at *H* and the solids at *F*.

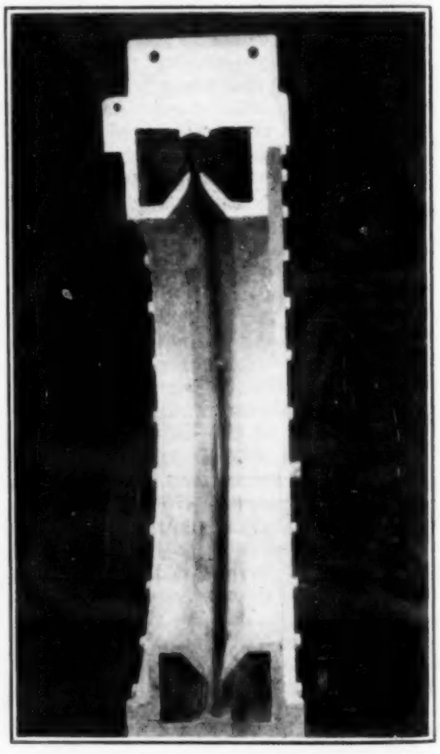


Fig. 4—Liquid Discharge Chamber of the Continuous Centrifugal Filter

This casting is one-half of the complete discharge chamber, which completely surrounds the rotating element.

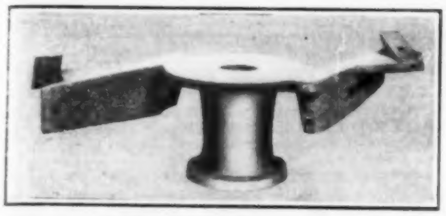


Fig. 5—View of the Scraper Arm Casting of the Continuous Centrifugal Filter

This view shows clearly the auxiliary scraper pieces which, extending to the inner part of the filter chamber, serve to remove the cake from that part.

granular material present, the larger is the percentage of colloids removed in each cycle of treatment.

Aluminum-Graphite Paint

The Dixon Crucible Co., Jersey City, N. J. have added to their line of paints an aluminum graphite paint. This paint is made primarily to meet the special requirements of the gas, oil, sugar and similar industries where an aluminum or other light colored paint is needed. Its use is recommended for gas holders, storage tanks and other exposed metal surfaces.

Floodlight

The Pyle-National Co., Chicago, Ill., have brought out a new design of floodlight projector, type 2375. This design has sufficient radiating surface, so that ventilation has been dispensed with and an air tight aluminum alloy case is used. This keeps out dust and other foreign matter, thus preventing depreciation in reflecting power, 1,000 or 1,500 watt lamps are used. Fittings and small parts are of bronze. The mounting base and trunnions are provided with locking devices, so that the adjustment of the unit is not disturbed in the course of maintenance work. Focussing is from outside the case. Pyle-National "Nonglare" or crystal glass reflectors 23 in. in diameter are used. Rectangular divergence lenses are optional with the unit.

Reduction Gear

A worm reduction gear for vertical shaft drive has been brought out recently by the De Laval Steam Turbine Co., Trenton, N. J. The advantage of such a gear is that it does away with bevel gears or complicated belting and permits of a drive that interposes but one worm and wheel between a horizontal motor shaft and a vertical machine shaft.

This reduction unit is provided with an oil tight case, in which both the worm and the wheel dip into oil. The lower wheel shaft bearing is immersed in oil and has spiral grooves to insure circulation of the oil. A small oil pump is incorporated, providing lubrication for the upper wheel bearing and thrust plate. For the larger units, in which it is not desirable to immerse the worm and wheel in oil because of the fluid friction, a positive pressure oiling system is used to feed oil to all bearings and to the worm threads and gear teeth.

Welding Equipment

The General Electric Co., Schenectady, N. Y., has recently put on the market a new automatic welding outfit particularly designed for the construction of small tanks. This equipment includes two separate automatic arc welding machines, one for welding longitudinal seams and the other for circular seams. The equipment is designed for tanks running from 11 to 33 in. in diameter and up to 6 ft. long.

Manufacturers' Latest Publications

C. M. Kemp Mfg. Co., Baltimore, Md.—A booklet describing the Kemp Automatic Gas System for the pre-mixing of fuel gas and air prior to delivery to burners.

General Electric Co., Schenectady, N. Y. —Bulletin No. GEA-10—A catalog of mechanically operated flow meters for measuring fluids and gases.

Philadelphia Gear Works, Philadelphia, Pa.—Bulletin No. 10-25—A descriptive bulletin of worm and spur gear speed reducing units of various types.

Pennsylvania Pump & Compressor Co., Easton, Pa.—Bulletin No. 125—A condensed general catalog of the complete line of compressors, pumps and other equipment made by this concern.

Foote Bros. Gear & Machine Co., 215 No. Curtis Street, Chicago, Ill.—Catalog No. 26 —A new general catalog of "IXL" speed reducing units of various types made by this company.

Caterpillar Tractor Co., San Leandro, Calif.—A descriptive catalog of the type 30 caterpillar tractor.

Denver Fire Clay Co., Denver, Colo.—A folder describing oil burners for various types of industrial heating operations.

Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Illinois.—Catalog 80-0—A catalog describing the use of the diamond core drill for drilling oil wells.

The Bristol Company, Waterbury, Conn. —Catalog No. 1600—A catalog of mechanical motion and electrical operation recorders.

Buffalo Foundry & Machine Co., Buffalo, N. Y.—A folder describing evaporators for mercerizing liquor.

U. S. Industrial Chemical Co., Inc., 110 E. 42nd St., New York City.—A catalog of solvents, cotton solutions and plasticizers for lacquers.

The Plumbago Crucible Association, 90 West St., New York City.—A booklet on crucibles entitled "How to Cut Crucible Costs."

B. F. Sturtevant Co., Hyde Park, Boston, Mass.—A leaflet on the Sturtevant coal-burning blower for use with small furnaces burning buckwheat coal.

Jonathan Bartley Crucible Co., Trenton, N. J.—A new catalog giving specifications and information on the use of graphite crucibles for foundry practice.

The Philip Carey Co., Lockland, Cincinnati, Ohio.—Catalog No. 1362-A — A catalog of asbestos and magnesia products for pipe and boiler covering.

Link-Belt Co., Chicago, Ill.—An illustrated booklet commemorating the 50th anniversary of this concern.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Two series, each of five articles, the first by Prof. H. N. Boylston, dealing with heat-treating, and the second by Prof. C. W. Parmelee, dealing with ceramics. These articles are similar in nature to the articles on combustion written by Professor Gebhardt, and published by this company during 1924.

Denver Fire Clay Co., Denver, Colo.— A folder describing furnaces for assay purposes.

Reliance Electric & Engineering Co., Cleveland, Ohio. — Bulletin No. 4000 — A bulletin on ball and roller bearing motors of the direct and alternating current type.

Harold E. Trent, 259 N. Lawrence St., Philadelphia, Pa.—Leaflet TB-4—A leaflet describing the Trent electric melting pot for continuous service in melting metals of low melting point containing antimony.

General Electric Co., Schenectady, N. Y. —Bulletin No. GEA-198—A description of a portable timing device for use in checking rotating meters and similar devices.

Griscom-Russell Co., 90 West St., New York City.—Bulletin No. 411—A bulletin describing heat transfer equipment for the petroleum industry.

Walworth Mfg. Co., Boston, Mass. — Bulletin No. 2—The summary of a distortion test on a 4 in., 400 lb. working steam pressure Walworth Sigma steel flanged tee.

Allen & Billmyre Co., Inc., 730 Grand Central Palace, New York City.—Bulletin No. 130—A bulletin descriptive of blowers and exhausters of the multi-stage centrifugal type.

Standard Conveyor Co., North Saint Paul, Minn.—A folder descriptive of the use of gravity and pneumatic conveyors in the baking, food and drug industries.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.—Bulletins Nos. 1228 and 1823—The first of these bulletins describes the "Texrope" drive, which is a flexible and positive drive for close centers. The second bulletin describes crushing rolls of the Garfield type, such as are used for crushing low grade copper ores.

General Electric Company, Schenectady, N. Y.—Bulletin No. G.E.A.-123—A new catalog of automatic voltage regulators, describing the different types of equipment and their application.

Hagan Corporation, Pittsburgh, Pa.—A new bulletin describing the Hall System of treating feed water for boilers.

Thyle Machinery Company, 129 Fremont Street, San Francisco, Cal.—A bulletin on the Bradley valve for the automatic control of underflow from thickeners, settlers and classifiers.

Steere Engineering Co., Detroit, Mich.— Pamphlet 280—A bulletin on clinker, ash and cleanout doors.

Charles Cory & Son, Inc., 183 Varick St., New York City.—Bulletin No. 201-29 B—A new bulletin on seamless metal hose for use with high pressure vapors, liquids and gasses.

General Electric Company, Schenectady, N. Y.—Bulletin GEA.-158—A new catalog of portable instruments for direct and alternating current.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.—Bulletin 1132—A bulletin describing polyphase induction motors of the types designated AR and ARY, with cast steel frames and Timken tapered roller bearings.

Connersville Blower Company, Connersville, Ind.—Bulletins Nos. 4-C and 18-D— The first of these bulletins deals with the use of rotary positive blowers for raw water ice systems. The second deals with the rotary displacement meter for the measurement of gas.

Perolin Company of America, 1112 W. 37th Street, Chicago, Ill.—A new bulletin describing the "Sandit" sand blast flue cleaner for cleaning boiler tubes.

American Blower Co., Detroit, Mich.— Bulletin No. 6103—A catalog describing and giving specifications of the American H. S. single inlet fan, a new fan of the Sirocco type.

The International Nickel Co., 67 Wall St., New York City.—The October, 1925, issue of the Buyers' Guide, giving the names and addresses of manufacturers using Monel metal and nickel in their products.

Crouse-Hinds Co., Syracuse, N. Y.— Folder No. 8—A folder on tumbler switch Condulets.

General Ceramics Co., 50 Church St., New York City.—Bulletin T—A bulletin describing chemical stoneware filters of suction, pressure and gravity types.

Electric Machinery Mfg. Co., Minneapolis, Minn.—Bulletin No. 812—A bulletin giving specifications and description of belted synchronous motors.

Hardinge Company, 120 Broadway, New York City.—Bulletin Nos. 29 and 30—The first of these bulletins treats of the rotor spray for gas scrubbing, air conditioning, absorption, concentration, mixing, aeration, heating and cooling. The second of these bulletins deals with a super-thickener and clarifier for separating liquids and finely divided solids.

Chicago Firebrick Co., 111 West Washington St., Chicago, Ill.—A bulletin on "Brikset," a high temperature cement for bonding firebrick.

DeLaval Steam Turbine Co., Trenton, N. J.—Catalog B—A new catalog of single-stage and multi-stage centrifugal pumps for all types of service.

Uehling Instrument Co., Paterson N. J.— Bulletins Nos. 118 and 118a—Two new bulletins describing the Apex CO_2 meter and its operation.

Patents Issued Nov. 10 to Dec. 1, 1925

Paper, Pulp and Sugar

Process for Making Paper Pulp. Bertram T. McBain, John E. Alexander, and Gosta Genberg, Port Edwards, Wis., assignors to Nekoosa-Edwards Paper Company, Port Edwards, Wis.—1,560,591.

Quick-Cook Sulphite Process. Philip C. Ulmen, River Rouge, and Herman H. Becker and Russell T. Mann, Detroit, Mich. —1,560,881.

Process of Treating Waste Sodium Monosulphite Liquors. Viggo Drewsen, Larchmont, N. Y., assignor to West Virginia Pulp and Paper Company, New York, N. Y. —1,560,900.

Control of Bisulphite - Pulp Cooking. Joseph Ernest Fleury, Three Rivers, Quebec, Canada.—1,562,217.

Composite Moistureproof Paper Board. Otto Kress, Appleton, Wis., assignor to American Lakes Paper Company, Chicago, Ill.—1,561,471.

Waterproof and Greaseproof Paper. Lester Kirschbraun, Chicago, Ill.—1,561,728.

Utilizing Sulphite Cellulose Lye. Carl Gustav Schwalbe, Eberswalde, Germany.—1,564,142.

Process of Recovering Sodium-Acid Sulphite from the Waste Liquors of the Sodium-Acid-Sulphite Pulp Process. James Beveridge, Richmond, Va., assignor to James Brookes Beveridge, Richmond, Va.—1,560,649.

Paper-Making Machine. Alexander J. Lewthwaite, Portland, Ore.—1,563,095.

Method and Apparatus for Use in Sorting Paper. Guy F. Hosmer, Rumford, Me., assignor to Oxford Paper Company, Rumford, Me.—1,563,747.

Process of Extracting Sugar from Beets. Ineo De Vecchis, Rome, Italy, assignor to Home and Colonial Investments Limited, London, England.—1,562,151.

Rubber and Synthetic Plastics

Method of Treating Rubber Composition. John B. Dickson, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,564,050.

Accelerator for the Vulcanization of Rubber. Adrien Cambron, Tottenville, N. Y., assignor to The Roessler & Hasslacher Chemical Company, New York, N. Y. —1,562,146.

Process of Treating Rubber and the Products Thereof. Omar H. Smith, New York, N. Y., assignor to The Naugatuck Chemical Company.—1,562,262.

Incorporation of Rubber in Non-Aqueous Materials. John Morris Weiss, New York, N. Y.—1,563,410.

Process of Splicing Uncured Rubber Compounds. Erwin E. A. G. Meyer, Detroit, Mich., assignor to Morgan & Wright, Detroit, Mich.—1,561,942.

Machine for Treating Rubber or Other Plastic Material. David R. Bowen, Ansonia, and Carl F. Schnuck, New Haven, Conn., assignors to Farrel Foundry & Machine Company, Ansonia, Conn.—1,561,903.

Process of Manufacturing Plastic Compositions. Bela W. Rote, Cleveland, Ohio. —1,563,872.

Plastic Mass and Process of Making Same. Leon Lilienfeld, Vienna, Austria. —1,563,204.

Petroleum Refining

Process for Purifying Mineral Oils. Jacob F. Faber, Los Angeles, and Henry C. Hanna and Marvin L. Chappell, El Segundo, Calif., assignors to Standard Oil Company, San Francisco, Calif.—1,562,156.

Method of Purifying Hydrocarbons. Adolph Greenspan, Minatitlan, Vera Cruz, Mexico.—1,562,425.

Oil-Cracking and Carbon - Removing Method and Apparatus. Lynton D. Wyant, Tulsa, Okla.—1,563,818.

Art of Preparing Lubricant-Carrier Material. Arman E. Becker, Newark, N. J., assignor to Standard Development Company.—1,562,138.

Method of Treating Oil. Paul W. Prutzman and Carl J. von Bibra, Los Angeles, Calif., assignors to General Petroleum Corporation, Los Angeles, Calif.—1,562,001.

Process of Making Motor Spirits and Refining Petroleum Products. Benjamin T. Brooks, Bayside, N. Y., assignor, by mesne assignments, to Carbide and Carbon Chemicals Corporation.—1,563,012.

Process of Recovering Oil From Shale. Carl S. Fogh, Philadelphia, Pa., assignor to Ore Roasting Development Company, Philadelphia, Pa.—1,563,271.

Process of Distillation. Daniel Pyzel, Piedmont, Calif., assignor to Simplex Refining Company, San Francisco, Calif. —1,562,723.

Cracking Still for Mineral Oils. William L. Bagwill, Long Beach, Calif.—1,560,891.

Process for Cracking Petroleum Oil. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,561,779.

Apparatus for the Fractionation of Petroleum. Henry P. Straus, New York, N. Y.—1,562,009.

Apparatus for Distilling Oil. George W. Wallace, East St. Louis, Ill.—1,561,758.

Hydrocarbon Distillation. Henry G. W. Kittredge, Toledo, Ohio, assignor to Caroline A. Kittredge, Toledo, Ohio.—1,561,169.

Oil-Shale Retort. Stephen H. Corfield, San Diego, Calif.—1,562,541.

Process for Removing Acids from Oils. Paul W. Prutzman and Paul D. Barton, Los Angeles, Calif., assignors to General Petroleum Corporation, Los Angeles, Calif. —1,562,000.

Combustion, Furnaces and Refractories

Manufacture of Fuel Briquettes. Thomas Augustus Goskar, Burnham-on-Sea, England.—1,561,322.

Treatment of Finely-Divided Coal and the Production of Briquettes. Edwin Edser and Walter Henry Beasley, London, England, assignors to Minerals Separation North American Corporation, New York, N. Y.—1,562,876.

Process for Briquetting Fuels. Robert Kattner, Grochau, Germany, assignor to Frankensteiner Magnesitwerke A. G., Grochau, Germany.—1,562,564.

Retort for the Carbonization of Solid Fuels. Augustin Léon Jean Queneau, Frejus, France, assignor to Edmund Heisch, Paris, France.—1,560,855.

Retort Furnace. Owen David Lucas, London, England, assignor to Vickers Limited, Broadway, Westminster, England.—1,561,735.

Coking Process. Frederick W. Sperr, Jr., Pittsburgh, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,563,595.

Cooling Plant for Coke. Arnold Moettell, Winterthur, Switzerland, assignor to Sulzer Frères Société Anonyme, Winterthur, Switzerland.—1,562,181.

Plastic Fire Brick. William A. L. Schaefer, Chicago, Ill., assignor to Plibrico Jointless Firebrick Company, Chicago, Ill. —1,561,571.

Refractory Material and Method of Producing the Same. William A. Harty, Blasdell, N. Y.—1,563,853.

Refractory Composition. William A. Farish, Brooklyn, N. Y.—1,561,641.

Inorganic Processes

Process for the Production of Sulphuric Acid. Hans Klencke, Frankfort-on-the-Main, Germany, assignor to American Lurgi Corporation, New York, N. Y.—1,561,985.

Method of Making Arsenates. Harry P. Bassett, Cynthiana, Ky.—1,562,490.

Method of Making Arsenates. Thomas Austin Mitchell, Ridgewood, N. J., and Kebe Toabe, New York, N. Y.—1,564,093.

Process for the Purification of Phosphoric Acid Containing Arsenic. Otto Wolfes and Horst Maeder, Darmstadt, Germany. —1,562,818.

Method of Producing an Allotropic Form of Sulphur. Henry H. Wilkinson, Brooklyn, N. Y., assignor to Union Sulphur Company.—1,560,926.

Production of Silicic Acid. Newell L. Collins, Clarinda, Iowa.—1,562,940.

Zirconium-Oxide Complex and Method of Producing and Using the Same. Charles J. Kinzie, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Company, New York, N. Y.—1,562,890.

Process of Treating Decolorizing and Clarifying Hydrous Magnesium Silicates. Marvin L. Chappell, Inglewood, Calif., assignor to Standard Oil Company, San Francisco, Calif.—1,562,868.

Process of and Apparatus for Producing Cement. Tsuneichi Fujiyama, Tokyo, Japan.—1,561,070.

Method of Making Cement. Andrew Gilbert Croll, Weatherly, Pa., assignor to The Atlas Portland Cement Company. —1,562,207

Process of Absorbing Hydrochloric-Acid Gas. James Ernest Egleson, Ridley Park, Pa., assignor to General Chemical Company, New York, N. Y.—1,563,732.

Organic Processes

Cellulose Acetate Composition. Stewart J. Carroll, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y. —1,560,542.

Process of Manufacturing Cellulose Acetate. Albert F. Sulzer, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,560,620.

Process of Spinning Artificial Silk and Other Filaments from Cellulose Materials. Harry P. Bassett, Cynthiana, Ky., and Thomas F. Banigan, Philadelphia, Pa., assignors to Meigs, Bassett & Slaughter, Inc., Philadelphia, Pa.—1,560,965.

Process of Preparing Viscose Solutions. Elie S. Humboldt, Oakland, Calif., assignor to The Pacific Lumber Company, San Francisco, Calif.—1,562,885.

Process of Manufacturing Artificial Silk and Other Products from Nitrocellulose. Emile Bindschedler, Lansdowne, Pa., assignor to Tubize Artificial Silk Company of America.—1,562,076.

Method of Nitrating Cellulose. George Juer, Hopewell, Va., assignor to Tubize Artificial Silk Company of America. —1,562,093.

Process of Treating Cellulose-Acetate Reaction Mixtures. Edward S. Farrow, Jr., Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y. —1,560,554.

Sulfonated Oxy - Dianthraquinonylamine Dyestuffs and Process of Making the Same. Walter Mieg, Vohwinkel, and Heinrich Raeder, Leverkusen, near Cologne, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,564,091.

Synthesizing Higher Molecular Organic Compounds Containing Oxygen. Gustav Wietzel and Rudolf Wietzel, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,562,480.

Azodyestuff. Richard Stüsser, Koln-Deutz, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany. —1,560,949.

Indigoid Dyestuffs. Bertram Mayer, Basel, and Jakob Würgler, Neuewelt, near Basel, Switzerland, assignors to The Society of Chemical Industry in Basel, Switzerland. —1,561,560.

Process of Making Alkyl Chlorides. William R. Webb, Rochester, N. Y., assignor, by mesne assignments, to Carbide & Carbon Chemicals Corporation.—1,560,625.

Electrolytic Cells and Processes

Electrolytic Cell. William Hoopes, Pittsburgh, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.—1,562,090.

Dry-Cell Battery. John Harris, Cleveland, Ohio, assignor to Charles M. Fulkerson, Cleveland, Ohio.—1,560,798.

Electrolyte for Galvanic Elements. Rudolf Pörscke, Hamburg, Germany. —1,562,517.

Dry Cell. William F. Hendry, Ossining, N. Y., assignor to The Manhattan Electrical Supply Company, New York, N. Y. —1,563,628.

Galvanic Cell of the Copper-Oxide Type. George W. Heise, Bayside, N. Y., assignor to National Carbon Company, Inc. —1,563,980.

Chemical Engineering Equipment

Crushing-Roll Apparatus and Process. Henry Kenyon Burch, Los Angeles, Calif. —1,562,617.

Method of and Apparatus for Pulverizing Material. John M. Hopwood, Dormont, Pa., assignor, by mesne assignments, to The Bonnot Company, Canton, Ohio.—1,561,235.

Drier. Walter M. Schwartz, Philadelphia, Pa., assignor to Proctor & Schwartz, Incorporated, Philadelphia, Pa.—1,562,260.

Method of Drying Material. Bernard R. Andrews, Braintree, and Stanley P. Lovell, Brockton, Mass.—1,560,589.

Drying Apparatus. Joseph L. Buckley, Trenton, N. J., assignor, by mesne assignments, to Proctor & Schwartz, Incorporated, Philadelphia, Pa.—1,563,961.

Drying Apparatus. Gordon Don Harris, Islip, N. Y., assignor, by mesne assignments, to The Industrial Dryer Corporation, Stamford, Conn.—1,562,759.

Centrifugal Separator. Henry Patrick Hoyle, Durham, England.—1,563,491.

Evaporator. Henry D. Miles, Buffalo, N. Y., assignor to Buffalo Foundry & Machine Company, Buffalo, N. Y.—1,562,713.

Process for Recovering Diatomaceous Earth from Waste Material. Richard C. Williams, Baltimore, Md.—1,561,042.

News of the Industry

Synthetic Ammonia Featured In Report to Congress

In his annual report to Congress the Secretary of Agriculture refers as follows to the accomplishments of the Fixed Nitrogen Research Laboratory: "The most striking recognition of the work of the Fixed Nitrogen Research Laboratory during the last year has been the adoption of its synthetic-ammonia process by an American company. The company, with the co-operation of the laboratory, has applied the process in a plant that was put into successful operation in the spring of 1925. This is an outstanding result of research work extending over several years. The plant operates at a pressure of 300 atmospheres and is capable of producing 3 tons of ammonia per day. Its successful operation within so short a time after its construction demonstrates the soundness of its design. The synthetic-ammonia process is in a continual state of development. The present process, with its various improvements, may be regarded as a considerable step in advance of the Haber process as originally installed in Germany. Another process, the French or Claude process, is now being installed in this country.

Although it has been recognized for a long time that some nitrogen from the atmosphere becomes fixed in the form of cyanide in blast-furnace gases, no serious effort has been made in this country to determine whether the quantity is commercially important and whether it would be feasible to recover it. No actual attempts at recovery have ever been made. In co-operation with the Bureau of Mines a complete survey has been made of one blast furnace in the Birmingham district. The results of the survey show that cyanide is produced in the gases in a concentration which should render its recovery economically profitable. This survey will be extended to other blast furnaces with the ultimate object of recovering this source of cyanide which would otherwise be wasted and which is essential in producing hydrocyanic acid for application as an insecticide in the citrus-fruit industry.

In the realization of the difficulties that will be encountered in the direct introduction of concentrated forms of nitrogen into the fertilizer industry this laboratory has been co-operating with other bureaus in the department. The object of this co-operation is, on the one hand, to prepare the way for stimulating the use of concentrated fertilizers from the agricultural standpoint, and on the other, to give the farmer the advantage of such use through obtaining proper freight rates on the concentrated products. This will mean a reduction in the cost of shipping the smaller tonnage of the concentrated material. Active co-operation with the Bureaus of Soils, Plant Industry, and Agricultural Economics has been sought and obtained in the prosecution of these objects."

Plans for Checking Wastes in Marketing Commodities

Practical steps to check the wastes in marketing characterized by Secretary Hoover as eing of vast importance, are outlined in a survey of the Expenses of Doing Business, the results of which have been made public today in preparation for the general meeting of the National Distribution Conference to be held in Washington, Dec. 15 and 16.

The survey, made by a committee representative of all classes of distributors, constitutes the first concerted effort on the part of business to trace all the items of marketing expenses that go to make up the consumer's dollar, which are found to range from 24 cents in the case of meats to 52 cents in the case of furniture.

The report of the committee making the survey, of which Robert R. Ellis, President of the Hessig-Ellis Drug Company, of Memphis, is chairman, discloses in sharp outline the difficulties that are encountered in attempting to check the wastes in marketing which are held accountable in the public mind for huge losses and consequent high prices. These are due, the committee finds, mainly to the lack of uniformity and adequate cost records.

"In addition to the generally recognized expenses of distribution there are many others which, because of their intangible nature and concerning which little information is available, may be discussed intelligently but not conclusively," the committee finds. "These are exemplified by such losses as are due to lack of sufficient records, failure to budget or plan for the future, incompetence, damage to stock, changes in style, shrinkage, ignorance, human mistakes and misdirected advertising. When the amounts of all these expenses have been discovered, it will be possible to adopt a more definite program in order to eliminate the wastes due to these intangible costs."

Helium Supply To Be Developed in Canada

The Ontario Government has officially announced that a deposit of helium gas has been discovered at Inglewood, about forty miles northwest of Toronto. Three wells there have been purchased by the Government, who have for some time been extracting gas from them in co-operation with the University of Toronto, and among other objects, using it with a view to increasing the efficiency of machinery of the Hydro-Electric Power Commission.

In making the announcement, Premier Ferguson said: "I am informed that they have the highest content of this gas of any in the British Empire. The wells have been turned over to the University of Toronto for research work. Though I see no immediate commercial possibilities in the discovery, the gas will undoubtedly take a big place in the scientific field of Ontario and the world.

R. B. Harkness, natural gas commissioner for Ontario, was associated with Professor J. E. McLennan in carrying out the field work necessary after the discovery.

Chemistry Building Planned for Iowa Cornell

A chemistry building for Cornell college, Mount Vernon, Iowa, which shall adequately fill the needs of its live department for the reasonable cost in keeping with a moderate-sized liberal arts institution, is the project which the Cornell faculty and administration has just undertaken. Tentative plans provide for a three story brick building with part of a fourth floor available for use, and an underground room adjacent to the building for the storing of inflammable and explosive chemicals. The three laboratories, organic, analytical and elementary, are placed immediately above one another, so that a minimum of piping will be necessary. Research laboratories, lecture rooms, offices, water analysis facilities, and bacteriology department are included in the plans, also a chemical library with a capacity of 5,000 volumes.

Low Prices Increase German Use of Fixed Nitrogen

German agriculture is absorbing 50 per cent more fixed nitrogen than when it was dependent on Chile nitrates, it is reported. German farmers are being supplied with nitrogen at prices 20 to 30 per cent below the world price.

Chemical Engineers Inspect Cincinnati Industries

Elect Officers and Select Berlin for Summer, and Birmingham and Atlanta for Next Winter Meeting

The 18th Annual Meeting of the American Institute of Chemical Engineers was held in Cincinnati Dec. 2 to 5 with headuarters at the Hotel Sinton. About 200 members and guests registered in the course of the meeting.

Officers for the calendar year 1926 were elected as follows: President, Hugh K. Moore; third vice president, J. V. N. Dorr; secretary, John C. Olsen; treasurer, Martin H. Ittner; auditor, David Wesson. Members of Council to serve for 3 years, A. H. Hooker, H. E. Howe and S. W. Parr.

The next meeting of the Institute will be held in June, 1926, at Berlin, N. H., where the principal technical feature will be symposium on corrosion under the direction of Dr. Paul D. Merica. The winter meeting of 1926 will be held in December and will comprise a trip to Birmingham and Anniston, Ala., and Atlanta, Ga. The feature of this meeting will be a symposium on factors affecting the selection of plant sites, under the direction of A. E. Marshall.

Dr. Maximilan Toch reported for the Patent Committee that the outlook for reformatory measures in patent procedure is better than at any previous time. He reported the sympathetic attitude of the Department of Commerce and the Commissioner of Patents toward the measures proposed by the Institute. New bills will be drawn up for presentation to Congress suggesting a Patent Court of Appeals in Washington to be appointed by the Supreme Court of the United States from men who have had exceptional experience in adjudicating patent litigation and have shown marked aptitude for that work. Legislation will also be asked revising the system of pay for patent examiners and other employees of the Patent Office so that their renumeration will be more nearly commensurate with the importance of their service to industry.

The Committee on Chemical Engineering Education, H. C. Parmelee, Chairman, reported that it had taken no important action since reporting the list of approved educational institutions at the Providence meeting. The committee expressed the opinion, however, that it would be desirable to extend the list of educational institutions giving approved courses in chemical engineering, and announced that it was prepared to give immediate consideration to such schools as desired to make representations to the committee. A general conference on chemical engineering education will be held by the committee in New York City early in the spring of 1926 to which representatives of educational institutions and industrial establishments will be invited. This conference will be similar to the one held three years ago and should be helpful in further harmonizing and unifying the views of educators and industrialists on this important subject.

Two features of the Cincinnati meeting deserve special mention. An unusually large number and diversity of industrial plants were open to inspection and the excursions were exceptionally well organized. The system of co-operative education in vogue at the University of Cincinnati was the subject of an evening lecture by Dean Herman Schneider, and a special paper on chemical engineering under the co-operative system by R. S. Tour, Head of the Department of Chemical Engineering. This system of engineering education is unique in the United States.

The power resources of the Cincinnati district were impressed upon members of the Institute by a special trip to the new steam generating plant of the Columbia Power Company at Columbia Park near the confluence of the Great Miami and Ohio Rivers. The ultimate capacity of this plant will be 320,000 kw. and the output is expected to compare favorably in cost with hydroelectric power at Niagara Falls.

Among the entertainment features of the meeting were a dance following a concert by the Syrian Temple Shrine Band, luncheon at the Procter & Gamble dining hall, and theater and card parties for the ladies.

Pound Basis for Linseed Oil Trade To Be Discussed

Effective Oct. 1, some of the leading linseed crushers announced that they would quote and sell linseed oil on a point basis. The trade custom had been to give quotations on a gallon basis and to make sales accordingly. The gallon, however, was specified as equivalent to 7½ lb. and actual transactions were on a weight rather than a volume basis.

A recent report from Washington says that producers, distributors and consumers of linseed oil, in the near future, will discuss the advisability of adopting the pound basis in the trade in that commodity. The necessary preliminary steps are being taken by the chemical and simplified practice divisions of the Department of Commerce. The feeling in the linseed oil trade is said to be almost unanimously in favor of the change.

A similar feeling is said to exist among those engaged in the naval stores trade. Since most of those interested in linseed oil also handle turpentine and rosin, it is probable that the adoption of volume units for those commodities also may be considered at the same meeting.

Hotchkiss Made President of Chemical Salesmen

Benjamin Hotchkiss of the Hooker Electrochemical Co. has been selected to succeed E. A. Johnson as president of the Chemical Salesmen's Association. Mr. Johnson was formerly manager of the New York office of the Monsanto Chemical Works, but is now located at the St. Louis office of the company. The vacancy as secretary of the association resulting from the recent resignation of William Adkins has been filled by the election, to that office, of William Mueller, sales manager of the Commercial Solvents Corp. The annual Christmas party of the association will be held at the Builders Exchange, New York, on the evening of Dec. 29.

Chemical Manufacturers Honor George Eastman

S.O.C.M.A. at Annual Meeting Hears Film Maker, Baekeland and Others Discuss Progress of Industry

George Eastman, elected an honorary member by the Synthetic Organic Chemical Manufacturers' Association at its annual meeting in New York, December 11, declared that the financial loss incurred by the special chemicals department of the Eastman Kodak Co. was being willingly met as his company's contribution to the chemical independence of the United States. Others to address the gathering included L. H. Baekeland of the Bakelite Corporation, Henry T. Claus, editor of the Boston *Evening Transcript* and Charles D. Lawrence, assistant attorney general of the United States in charge of customs litigation.

A feature of this year's annual meeting was a series of round table conferences at which prominent industrialists exchanged views with university men primarily interested in scientific research. Professor R. T. Haslam, Director of the School of Chemical Engineering Practice of M. I. T., led the discussion for the chemical engineering group and Dr. Marston T. Bogert presided over the section on organic chemistry. Fifty or more prominent educators participated in the discussion.

In his annual address to the association, the president, Dr. Charles H. Herty, declared that this meeting marked the first decade in the life of the industry and during that time it had accomplished what ten years ago all conservative minded men had thought was impossible. The dye industry has not only displaced German competition in this country and in other foreign markets, but the records show that for the first time American dyes have become a competitive factor in Germany itself.

Mr. Claus strongly condemned those of our citizenry who believe that protocols on the use of the submarine and poison gas in warfare would be absolutely binding among nations. "We should give them credit for their sincerity," he said, "but we cannot respect their judgment. Certainly no greater mistake would be made than to order our national affairs in conformity with their way of thinking. Opinions may well differ as to whether chemical warfare is humane warfare, but it seems to me obvious that the country which neglects preparation in this form of offense and defense is gambling heavily with its future."

At the executive session preceding the public meeting, Dr. Charles H. Herty was re-elected president of the association and the following vice-presidents were named: Dyestuffs section, August Merz of Heller & Merz; Crudes and Intermediates, W. F. Harington of the duPont company; Fine Chemicals, B. R. Tunison of the U. S. Industrial Chemical Co.; and Special Chemicals, P. S. Rigney of Roessler and Hasslacher Chemical Co. F. P. Summers of the Noil Chemical Co. was re-elected treasurer.

News from Washington

By Paul Wooton
WASHINGTON CORRESPONDENT OF *Chem. & Met.*

A DETERMINED effort will be made by friends of the Chemical Warfare Service to defeat the ratification by the Senate of the gas protocol drafted in connection with the protocol on international traffic in arms. While the greater portion of the support for the gas protocol comes from the peace-at-any-price element, it also has the support of well intentioned groups that have prestige and influence. It is recognized, however, that if the ratification of the treaty with regard to gas is prevented all of the influence which the chemical industry can command must be mustered.

The public seems to have gained the erroneous impression that the entire treaty must be defeated in order to prevent the agreement proposing to outlaw the use of gas in warfare. This is not the case. The gas protocol is an entirely separate document and its defeat will militate in no way against the ratification of the treaty on the international traffic in arms.

The gas protocol attempts to withhold that weapon from a nation, even though it may be fighting for its life. Were the United States to ratify this protocol the effect would be, it is believed, to preclude any chemical warfare activities if any country, no matter how small or inconsequential, should ratify it also. While the protocol makes the treaty effective only against those countries ratifying the agreement, the declaration of principle is such that the United States could be accused of inconsistency were it to continue its development of that branch of military science. Moreover, the ratification of the treaty probably would be regarded by the appropriations committees of Congress as a mandate against further expenditure of public funds for the chemical warfare service and thus retard its work in all directions.

Gas As Weapon of Defense

One of the points which will be stressed before the Foreign Relations Committee, when the hearings begin, will be that the development of chemical means of defense would be more than any other step that could be taken to insure the United States against attack. Our situation is such that we are in a position to make more effective use of gas as a means of defense than is any other country. To attempt to legislate this weapon out of existence, it will be argued, simply would make the United States more pregnable and invite attack.

There will be carefully worked out presentations to show that gas is an economical and efficient material for war use. An attempt also will be made to prove that it is more humane than explosive shells, other projectiles or even bayonets. In that connection, however, it will be pointed out that this will be the first time that the question of humanity has entered into the selection of weapons for use in war.

German Potash Loan

The administration is believed to have frowned upon the ambitious plans of the German Potash Syndicate to borrow $25,000,000 in this country, as a first installment of a $75,000,000 loan to be floated here and in London, because there were no assurances of material price reductions. It is believed in Washington that potash prices could be reduced 35 per cent were certain obvious economies put into effect by the German Syndicate.

It was not entirely clear why this concern, with larger reserves than any other German industry, should be planning a loan almost as large as the Dawes loan. Potash output is in excess of demand. The production already has been concentrated in sixty shafts. It may be that it was felt that the subsidies being paid to the nearly 200 higher-cost producers who have been closed down, were too large.

Much is made of the fact that potash prices are no higher than they were before the war but despite that fact the feeling is that they are exorbitant. The loan, it was thought by some, was intended to increase sales at more-or-less present price levels by offering very attractive credit arrangements.

An exhaustive survey of the potash situation has been completed by the chemical division of the Department of Commerce. It will be issued, as a seventy-five page bulletin, about Jan. 1.

The tendency toward consolidations in the nitrate fields of Chile is continuing. One large concern has extended its operations to the purchase of supplies. It even has gone into the packing business in southern Chile and is supplying most of the needs of many of the nitrate producers. Purchases of machinery and other supplies which must be imported, also are being made direct.

Production of helium in quantity from monazite sand is not feasible in the opinion of chemists in Washington. They do not take seriously the Associated Press dispatch to the effect that German scientists had found a new commercial source of helium in monazite sand.

All of the phthalic anhydride being manufactured in this country is being made by a process worked out in the Bureau of Chemistry, the Secretary of Agriculture says in his report to Congress. Before the war, he points out, this essential intermediate was obtainable only in Germany. Now many millions of pounds are produced annually in this country at a relatively lower price that that which prevailed before the war and the product is higher in purity. Instead of being dependent upon a single foreign source of supply the United States as a result of this process worked out by the Bureau of Chemistry is now an exporter of this intermediate, the Secretary states.

A commercial agreement has been concluded between France and Bulgaria, under the provisions of which each country grants to the other the minimum import duties on certain specified articles, according to a report received from Commercial Attaché Chester Lloyd Jones at Paris. The United States is not on a most-favored-nation footing with either Bulgaria or France, and will not, therefore, receive the benefit of any concessions granted by the treaty.

Alcohol Regulations

While the chemical industry was taken completely by surprise by the action of the Treasury Department on Nov. 14, in cancelling all permits for the use of alcohol as of Dec. 31, the storm of protest which it aroused was largely dispelled by a subsequent adjustment as to the effective dates which will insure against any break in the continuity of supply. Communications received by the prohibition authorities indicate that the legitimate alcohol trade is in entire sympathy with a review of the list of permitees.

General L. C. Andrews, the Assistant Secretary of the Treasury, in charge of prohibition enforcement, has convinced representatives of the industry, with whom he has discussed the matter, that there is going to be no interference with legitimate business. He has pointed out that he will keep in close personal contact with the representatives of the producers, distributors and consumers of alcohol. He has made it very clear, however, that he is going to do something to reduce the amount of industrial alcohol diverted for illegal purposes. He thinks the best way to do that is to divorce the sheep from the goats in the trade. Figuratively, at least, he is going to divide permitees into three classes. In class A will be those whose handling of alcohol is above suspicion. In class B will be placed those who will bear watching, and in class C will be grouped those who are under suspicion. A six months period probably will be allowed the Class C permitees to prove their good faith, but after that time the class will be eliminated entirely.

The Commissioner of Internal Revenue has thanked the members of his advisory committee on industrial alcohol and the body has passed out of existence. It is not the immediate intention of General Andrews to set up formal advisory committees. He first expects to try out the plan of calling in representatives of industry whom he thinks will be able to offer advice.

Those representatives of chemical industries who have conferred with General Andrews express themselves as much impressed with his ability and his very evident determination to be fair. They all are convinced that he is going to secure a much higher degree of prohibition enforcement than has been attained heretofore. One indication of that, one of his callers, remarked, is the fact that he spent thirty years in the regular army without a single day's detail in Washington. He was more interested in remaining in the field in the immediate contact with the discharge of the army's functions.

French Chemical Companies May Form Cartels to Meet Competition

Mergers or Sales Agreements May Be Forced to Offset German Attempts to Capture Chemical Markets of France

From Our Paris Correspondent

IT IS more evident in France than ever before that the German chemical industry wishes to recover the position it held before the war. It is already preparing its plans of action with the view of recapturing markets, lost in France, as soon as the London accord will have expired, in 1928. Thus the I. G., which until recently was only a community of interests, has merged the interested plants into a powerful trust including the entire industry except Cassella and Kalle. The I. G. has opened an office in Paris which is directed by Mr. Loewengard, former director of the Manufacture Lyonnaise at Lyons who has at his disposal an important staff of technicians and experts.

This situation is the cause of some concern to the French chemical industry which scatters its activities owing to the individualistic tendency of the French industrialists. It is possible, nevertheless, that having to face a formidable opponent will cause the chemical industry to unite into a trust or to set up selling cartels (called "comptoirs") such as are already in existence for rayon, tanning extracts and certain metallurgical products.

Chemical Exports Increase

Generally speaking, business has been very dull during the summer. Just at present there is a slight increase but the bulk of transaction is in exports. This is mainly due to the sharp depreciation of the franc which has again dropped recently. The countries with a high currency have been buying divers products in France and we note among the exports of the first nine months of 1925 the following products and the value they represent:

	Million Francs
Calcium carbide	6.4
Sodium sulphate	9.1
Glycerine	20.9
Tartar, crude	24.5
Caustic soda	50.4
Soda, refined	46.5
Superphosphates	29.5
Phosphoric slags	108.2
Potassium salts, crude	69.6
Anhydrous alumina	48.3
Natural dyestuffs, tanning extracts and synthetic dyestuffs (for 6 months)	82.0

These are only the more important products. There are others, such as sodium cyanide (for 5 million francs), sodium acetate, sodium hydro-sulphite, and finally trichlorethylene, demanded by Spain for the extraction of olive pulps. Certain export demands cannot be met, as for example prussiate for which the French production is hardly sufficient for domestic consumption.

In spite of the development of the chemical industries since the war, there are still certain products that French industry either does not produce or makes in an inferior quality as is the case with magnesium chloride. The German product is always preferred and is in fact superior to that obtained as byproduct of the liquors coming from salt-marches. On the other hand magnesia prepared from dolomite is too expensive with the existing processes of manufacture.

All in all, the outlook is rather uncertain and the result of the Franco-German negotiations as well as the financial steps announced in view of stabilizing franc, are waited for with a certain anxiety.

Kuhlmann Centenary

On Oct. 11, was celebrated, at Lille, the centenary of the founding of the Kuhlmann Establishments by the Alsatian chemist Frederic Kuhlmann. He was born at Colmar in 1803, and educated in Paris. He was called as a professor to Lille where, beginning in 1924, he taught applied chemistry for 30 years. While teaching he had established at Loos-les-Lille a sulphuric-acid plant with a capital of 200,000 francs and this plant was put into operation in May 15, 1826. Manufacture of soda by the Leblanc process was started in that plant in 1828 and later the production of the animal charcoal used in sugar-making.

To this plant was added a chemical products plant at Amiens, another at La Madeleine-lez-Lille, a fourth at Saint-André-lez-Lille; this group of plants was organized as the Manufacture of Chemical Products of the North, which was transformed in 1869 into a stock-company with a capital of 5,150,000 francs. Frederic Kuhlmann remained at the head of the enterprise until his death, in 1881; he was succeeded as the technical director by Julius Kolb.

Meanwhile new manufactures had been undertaken: the regeneration of manganese dioxide by Weldon, the inventor of the process; in 1887 the Deacon process for the preparation of sodium sulphate was put into operation. After the discovery of the phosphate deposits in the Somme, and in Algeria and Tunisia, the superphosphate industry was developed. In 1908 a contact plant for sulphuric acid was installed at Madeleine and at Watreloos.

Then came the war, during which the plants were damaged or destroyed by the Germans. But by the purchasing of plants situated in the South, for example at L'Estaque near Marseille, another near Bordeaux and other plants for glue, gelatin and tallow at Aubervilliers and at Nevers, and by taking interests in other enterprises, the company never ceased developing itself. After the armistice the plants in the North were rebuilt and developed to such an extent as to surpass the pre-war production. On January 1, 1924; the Kuhlmann Establishments merged with the Compagnie Nationale des Matières Colorantes created in 1917 and the capital was raised to 180 million francs.

The tonnage produced by this firm in 1924 amounted to 995,000 tons made up particularly of heavy chemical products, two-fifths of which were superphosphates. Dyestuffs and organic products represent about 9,000 tons corresponding to 1,000 different makes.

Centenary of Chevreul

On Oct. 11, was likewise celebrated at the Museum of Paris, which was itself formerly the laboratory of Chevreul, the centenary of the work of Chevreul on the constitution of fats of vegetable and animal origin.

The first patent for the preparation of stearic acid was granted in 1825 to Chevreul and Gay-Lussac. These inventors saponified the fats by soda, liberating the fat acid with muriatic acid and eliminating the liquid fat acids by pression and treatment by alcohol. These processes were however too expensive. De Milly introduced, in 1831, the saponification by lime and did the hot pressing of the acids. By 1834, the success of the stearic candle was evident. The first plant had been set up in Paris near the present Place de l'Etoile; hence the name of Etoile-candles were given to the first products. De Milly and Mottard created later on, at Marseille, new plants which have since become the important Fournier Establishments. So likewise were established at Lyons divers stearine plants which, by merging in 1900, have been the basis of the Société de Stearinerie et Savonnerie. (Capital 8 million francs.)

The production of stearic candles could reach about 40,000 tons annually but these figures are on the decline due to the development of other modes of lighting which offer stiff competition.

One factor which saves the French industry is that since 1910 the hydrogenation of oils has opened to it new prospects and offered new markets. These processes are utilized in France by the Fournier Establishments previously referred to and also by the French Oxhydric in their plants of Marseille and Lyons. The production of solidified fats is estimated at about 20,000 tons.

German Chemical Industries Show Improvement

While Germany has been able to recover only half of its chemical markets in foreign countries, there are some bright spots in the gloomy situation, Counsellor Duisberg pointed out recently. The spot which is particularly bright is that represented by the nitrogen industry, but the pharmaceutical branch of the industry, Dr. Duisberg says, is making a good showing, largely due to the American demand for its products. Production in inorganic lines has been doubled. While the dyestuffs industry is in a bad way, Dr. Duisberg believes the reorganization of the dye cartel will result in simplification and new efficiencies. He fully expects chemical laboratories generally to be producers of increasing numbers of new products.

Private Lease Is Advocated for Muscle Shoals

Resolution Would Make Nitrates Production Primary—Two Reports from Commission

On Wednesday, Dec. 9, Representative Madden of Illinois, chairman of the Committee on Appropriations, introduced a resolution in the House, calling for the formation of a joint congressional committee to conduct negotiations for a private lease of the Muscle Shoals properties of the government. This committee, according to the resolution, is to report conclusions not later than the middle of next February.

The resolution provides the lease should be made "for production of nitrates primarily, and incidentally for power purposes in order to serve national defense, agricultural and industrial purposes, and upon terms which, so far as possible, shall provide benefits to the government and to agriculture equal to or greater than those set forth in the offer of Henry Ford for these properties in the 68th Congress as passed by the House of Representatives March 10, 1924, except that the lease shall be for a period not to exceed fifty years."

Early in the month the majority and minority reports of the Muscle Shoals Commission were made public. The majority report was signed by John C. McKenzie, Nathaniel Bial, and R. F. Bower. In substance, this report recommends the operation of Muscle Shoals property for the production of nitrates suitable for use in manufacture of explosives in time of war and of fertilizers in time of peace. It favors leasing the properties as a unit and not as separate entities. A private lease, not to exceed 50 years, is recommended but if such a lease cannot be negotiated satisfactorily, the report would have plans for government operation become effective within ninety days.

With regard to operations of the plants for power the report says there should be definite limitations placed upon the power to be distributed in order to protect the supply for fertilizer manufacture which is the primary purpose of the enterprise.

In safeguarding the interests of the government, the proposed private lease would be granted subject to specific conditions. Among the latter it is stipulated that the lessee will produce an annual amount of 18,000 tons of fertilizer after the third year, of which at least one-third shall be nitrogen, and after the fourth year, the annual production shall be progressively increased up to a maximum of 70,000 tons in the tenth year of the lease period. Provision also is made that the profit from operation of the properties shall not exceed 8 per cent on the fair annual cost of production.

The report concludes with a statement expressing the reluctance with which government operation was suggested. This step, which is suggested only if private operation cannot be arranged, was deemed necessary by the great investment of the government at Muscle Shoals, the importance of its continued maintenance as a part of our national defense, and the crying need of agriculture for more and cheaper fertilizer.

The minority report was signed by William McClellan and Harry A. Curtis. This report considers private leases not only desirable but indispensable. It claims the best results will follow by separating the power and fertilizer leases because these industries have no affinity in personnel, corporate activity, commercial aims, or understanding of each others problems. Therefore the dissenting members advocate securing leases by a chemical manufacturing group or groups upon terms which will carry out the production of fertilizers and a separate lease of the power equipment.

This report says that since there are many details of the lease for the power facilities at Muscle Shoals which will have to be worked out in conference with the lessee, it is necessary that Congress authorize some agent of the Government to negotiate the lease for the power under whatever minimum requirements Congress may specify. Moreover it will be necessary to provide for the occasional revision of the price schedule for the power developed at Muscle Shoals in order to make sure that as the cost of producing power at Muscle Shoals decreases the benefit will accrue mostly to the consumer and not wholly to the lessee.

There are likewise a great many details to be worked out in negotiating leases with prospective manufacturers of fertilizers or of other useful products at Muscle Shoals. The art of fertilizer manufacturing is in a state of flux and no one can foresee what the best procedure in this field may be in a few years hence. It is essential that there be provided a continuing agency through which the new situations in this field can be handled as they arise and in this way realize the greatest values from the potential resources at Muscle Shoals. In this case, as in the matter of negotiating the lease for power, it will be necessary for Congress to delegate authority to some Government agent, specifying the minimum requirements under which the leases may be negotiated.

Power Given to Bar Carbon Black Plants

Under a ruling of the attorney general of Louisiana, Nov. 14, the state, through its department of conservation, is accorded the power under act No. 250, 1920, to refuse further permits for the establishment and operation of carbon black plants. The opinion is expected to have a far-reaching effect in curtailing enterprises of this kind, particularly in Northern Louisiana, and will likely tend to eliminate the enormous consumption of natural gas in the Ouachita Parish fields. It is the first definite step taken by Louisiana in checking and controlling the industry, which, it is said, would soon deplete the natural gas supply. Pending applications for permits for such plants are being refused under the new ruling and forthcoming applications are expected to be given like treatment.

Decade of Changes in Domestic Fertilizer Industry

Pointing out new features and new factors which have entered the fertilizer situation in the United States since 1914, a special bulletin covering this subject has been released by the Department of Commerce.

The fertilizer industry is somewhat unique in the large number of raw materials used, and the chance for variations is therefore rather wide, the report states. Changes have occurred since 1914 with reference to nearly everyone of the ordinary fertilizer ingredients. Potash imports were cut off during the period of the World War and vigorous attempts were made to develop an industry in America. The result has been a production, apparently permanent.

Continuing along these lines, the department's bulletin explains the great change in the agricultural-nitrogen problem in the last ten years. The domestic production of ammonium sulphate has overtaken and passed the demand of the fertilizer industry. Tankage, fish scrap, and cottonseed meal have largely been diverted from the fertilizer industry to more profitable markets, and an air-nitrogen industry has been launched and has become a factor of increasing importance. Phosphate production has been least disturbed, it goes on to state, but even here the great agricultural depression of 1920 and 1921 made difficult times for the industry, and the exploitation of the phosphate deposits in Northern Africa, is influencing American exports of phosphate to Europe.

Sulphur Deposits Decrease Iron Ore Mining

The excess amount of sulphur in the form of gypsum which is now being found in iron ore properties near Crystal Falls, Negaunee and other locations in Michigan is threatening to close a number of large mines. The situation has grown so serious that mining companies are arranging to raise funds to assist in research and study of the problem. Large quantities of iron ore with a high sulphur content are accumulating in the upper peninsular, as the miners are encountering considerable difficulty in getting the smelters to treat it. For this reason, the research engineers and professors of the University of Michigan are endeavoring to find some way to remove the sulphur before the ore goes to the smelter, or to develop some new method of smelting through which the sulphur can be removed at a considerably less expense than at present.

New Coke and By-Products Plant For Canada

With a capital stock of ten million dollars, the British American Coke and By-Products, Limited, has been incorporated in Canada with a federal charter. The head office of the company will be in Toronto. No announcement has been made as to the operations of the company but the usual wide powers have been granted.

British Dyestuffs Co. Adopts Reconstruction Plan

New Arrangement Calls for Retirement of Government and Certain Preference Shares

The general meeting of the British Dyestuffs Corporation was held at Manchester, Eng., on Nov. 25. This was followed by an extraordinary general meeting of the company and by separate class meetings of shareholders, at which plans of reconstruction were adopted. The plan calls for payment of £600,000 to the Government which will cancel shares held by the latter of a face value of £1,580,000. A payment of £980,000 also was ratified to retire preference shares. The balance of the reduction in capital, amounting to £1,741,000 is effected by writing down the nominal value of the preferred and deferred ordinary shares, the former by one-third and the latter by two-thirds of their nominal value. Under the new plan the total capitalization of the corporation would be £5,578,468, but the directors proposal to retain the capitalization at £10,000,000 was adopted.

Lord Ashfield, who presided as chairman of the meeting, stated that they had effected, and are continuing to effect, improvements and economies in management, and the complaints as to the quality of productions are now very much rarer and much less justified.

He reported that the works cost have fallen considerably during the last few months and that the management had done its best to cut out dead wood. He announced that Dr. E. F. Armstrong had been appointed managing director and said: "He came to us from Joseph Crosfield and Sons' Works at Warrington with very high credentials and equipped with a knowledge and experience of especial value to our undertaking, and I am sure that every shareholder will desire to be associated with the board in their expression of goodwill and encouragement which has been extended to him. We also are fortunate in having officers of exceptional skill, who are working valiantly and without any thought for themselves in their efforts to bring success to our undertaking. In addition, the board will avail themselves of every opportunity to strengthen the organization and encourage a spirit of greater enterprise in the whole of our undertaking; but even so, all that we can do will not necessarily mean that we can make a profit out of the manufacture of dyestuffs. I doubt whether any large concern is making a profit out of the manufacture of colors today.

We recognize that in the business of making dyes we have to face a world competition, and that in order to succeed we must be able, ultimately, to sell at a world price. In such circumstances, your board are of opinion that the scope of the corporation's activities should be widened in order fully to make use of its assets. Although the shareholders can be assured that this board will not embark on any rash or hazardous enterprise, they hope to utilize the resources, the equipment, and the personnel of your undertaking in that wider range of activities which is now open under its proposed amended Articles. I am not able to indicate in what direction our pursuit for this wider use of our resources will take us, but I think it well to mention the matter so that you might know that the board are not unmindful of the need for engaging in the manufacture of other products which will, without prejudice to our main business, bring increased income to our corporation."

Before adjourning a motion to increase the number of directors was defeated and the present directors were re-elected.

Government Concludes Argument of Dye Case Appeal

The Government's argument in its appeal to have set aside the sale of the German chemical and dye patents to the Chemical Foundation, Inc., was concluded in the Supreme Court on Dec. 10 by Henry W. Anderson, special assistant to the Attorney General, who insisted the Alien Property Custodian had not the authority to make the sale.

Germany Is Active Buyer of Argentine Casein

According to a report from Trade Commissioner Mace at Buenos Aires, Germany is an active buyer of Argentine casein but the United States is still the principal outlet. In August, the exports amounted to 998,843 kilos, of which 466,540 kilos were sent to the United States and 355,063 kilos to Germany.

Short Courses in Clay Working at Illinois

The lectures and discussions provided for the short courses in clay working and enameling, which is to be given by the Department of Ceramic Engineering at the University of Illinois, Urbana, Ill., Jan. 11 to 23, 1926, are to meet the requirements of practical men. The principles discussed will be those which are fundamental to the work of managers, superintendents, foremen, burners and others.

Eighteen lecturers will participate, and among those will be M. C. Booze, Mellon Institute, Pittsburgh, Pa., who is widely and favorably known for his extensive knowledge of refractories; R. R. Danielson of the A. J. Lindemann and Hoverson Company, Milwaukee, Wisconsin, an expert on the enameling of metals, who was formerly in charge of the research of that sort in the Bureau of Standards; and Professor A. S Watts, Head of the Department of Ceramic Engineering at Ohio State University, well known for his contributions to ceramics.

Gain in Carbon Gas Production in 1924

The production of carbon black from natural gas in the United States in 1924, reported to the division of mineral resources of the Geological Survey prior to its transfer to the Bureau of Mines, by 46 producers operating 69 plants in nine states, amounted to 186,872,034 lb., an increase of 35 per cent over the production in 1923 and nearly three times the output in 1922. Indicated deliveries in 1924 by producers of carbon black amounted to 129,521,602 lb., contrasted with 102,376,381 lb. in 1923. On Dec. 31, 1924, stocks of carbon black held in the custody of producers amounted to 95,671,246 lb., an increase of more than 57,000,000 lb. over the corresponding stocks held on the last day of 1923. This record of overproduction was reflected in the average price per lb. received by producers, 6.2c., which is the lowest that has been reported since the government began to compile statistics of carbon black in 1919. The total value at the plants of the carbon black produced in 1924 was $11,564,936.

Alcohol Permits To Be Issued on Yearly Basis

Under date of Nov. 14 the acting commissioner of internal revenue issued a notice to prohibition administrators and others concerned, stating that all basic permits issued under Titles II and III of the National Prohibition Act shall expire on Dec. 31, 1925; and thereafter all basic permits issued prior to Aug. 31 of any calendar year shall expire on December 31 of the same year; and all basic permits issued after Aug. 31 of any calendar year shall expire on December 31 of the succeeding calendar year.

This was followed by a notice from Assistant Secretary Andrews to the effect that applications for renewals of alcohol permits would be acted upon prior to Dec. 31. The order in regard to the renewal of permits is to be made effective as follows:

(a) "All current permits for industrial alcohol plants, alcohol bonded warehouses, and denaturing plants, will expire Dec. 31 of this year, and you will immediately notify such permittees to make applications for renewal, before Dec. 31, 1925, if desired; and you will proceed with such investigations as will enable you to renew only such permits as are economically sound.

(b) All current permits for the use of denatured alcohol in manufacturing, etc., will be extended until each application has been reviewed and acted upon, which work must be completed by March 31, 1926. You will notify these permittees to make application for renewals by Dec. 31, 1925. You will proceed with such thorough investigation of these various business enterprises as will enable you to have passed upon all these permits prior to March 31, 1926.

(c) All current "H" permits for the use of non-beverage alcohol and other liquors, will be extended for the purposes of Governmental control until Dec. 31, 1926. In the meantime, you should instruct these permittees to make application for renewal for the year 1927, prior to July 1, 1926, and all of these permits should be definitely acted upon by Dec. 1, 1926. The object being to have acted upon these permits as early as possible in the season."

News in Brief

War Mineral Relief Claims Settled—Announcing that all War Mineral Relief claims had been fully adjusted, liquidated and paid with one exception, Secretary Work of the Interior Department has forwarded a final report to the President and Congress practically terminating this work of the Government. The report shows that the last 90 claims were considered during the past year and that a balance upwards of $950,000 remained unexpended out of the original appropriation of $8,500,000.

Alcohol Monopoly in Soviet Russia—According to a Government decree issued August 28, 1925, the distilling of 40 per cent alcohol in Russia can be carried on only by government distilleries. The sale of alcohol in Russia is also a government function. It can be sold only in government stores or specially licensed private shops. The new decree provides that private distilleries are also permitted to distill alcohol but they must deliver their entire production to the government.

Rockefeller Pledges Fund for Petroleum Research.—John D. Rockefeller has pledged a fund of $250,000 to the American Petroleum Institute for the initiation of a program of scientific research in petroleum, according to an announcement of the American Petroleum Institute. The fund is to be available in annual installments of $50,000 for five years, and to be expended primarily in supporting research fellowships in scientific institutions, the recipients of such fellowships to engage in research on some problem of the physics, chemistry or geology of petroleum; and the results of the work are to be made freely available to the industry and public generally.

International Explosives Trust Has Been Revived—The International Explosives Trust has been revived, according to the Berliner Togeblatt. It has been known for some time that the German Explosives Trust has been working actively to restore relations with the British Nobel Dynamite Trust Co. and the Dupont de Nemours Co. A long step in that direction has been taken through an agreement among the three concerns for the exchange of patents and the results of experiments and other close technical co-operation. The British and American companies are to take 15,000,000 marks of the new capital of the Dynamite A. G.

Fish Oil Plant for British Columbia—Vice-consul Roberts reports that a fish reduction plant will be constructed within the next few months at Quatsino on the north end of Vancouver Island and will be in operation next season. The purpose of the plant is to secure oil, fish meal, and fertilizer by the rendering of pilchards and dog fish. Four main classes of product will be secured, the principal one being fish oil from the pilchard which has a high iodine content and is used in varnishes, paints, leather working, soap making, steel tempering, and medicinal uses.

Synthetic Camphor in Spain—Reports from Madrid say that arrangements have been completed for the manufacture of synthetic camphor in Spain. It will be made by the Industrias Ruth, a subsidiary of the Spanish Resinera, with a factory at Santander. This company will make use of German patents in this enterprise.

National Directory of Simplified Commodities—Plans for a National Directory of Simplified Commodities are being concluded by W. Chattin Wetherill, Director of Metals Utilization for the Department of Commerce. The directory will contain a list of every commodity that has gone through the simplification mill. While only fifty simplification agreements have been reached, some 300 others are under consideration, so that the list soon will be longer. There are requests pending which cover more than 1,000 commodities.

Discovery of Bauxite in Montenegro—A report from Essen says that large deposits of bauxite have been discovered between Bar and Ulcin, Montenegro, which have been thoroughly investigated by the Vienese geologist Herr Körner. The deposits appear to resemble those found in Hungary and are estimated at 30,000,000 tons. The distance from the nearest port in the Bay of Mrkovac is only 9 kilometers. A Spalato firm has provisionally acquired the right to exploit the deposits but negotiations are pending with French and German firms for working them on a large scale.

Dusting From Airplanes To Be Increased Next Season

During the cotton-growing season of 1925 more than 50,000 acres of cotton were dusted with calcium arsenate dropped from airplanes and this area will be greatly increased within the next few years, according to the annual report of Dr. L. O. Howard, chief of the Bureau of Entomology, Department of Agriculture. Great progress has been made in the development of special planes for this service and in the testing of these planes, looking toward their still further improvement in the future, Dr. Howard stated. Studies have been conducted on the best methods of flying, the different dusting problems encountered and on the selection of the most suitable dust for these various conditions.

China Clay Deposit in Canada To Be Developed

Development of approximately 400 acres of china clay deposits at Kaolin City, on the Mattagami River, in Northern Ontario, Can., by a company incorporated with a capitalization of $7,500,000, is reported to be under way. The Ontario Government has undertaken to aid the scheme by promising to have the Temiskaming and Northern Ontario Railway extended from its present terminus about 70 miles north of Cochrane, Ont., to Kaolin City.

U. S. Ranks Tenth Among Producers of Nitrogen

Never before in history has there been such concentration on the chemical technology of a single element as is in progress in nearly all countries in connection with the fixation of nitrogen. This opinion was expressed by Dr. S. C. Lind, of the Fixed Nitrogen Research Laboratory of the Department of Agriculture, in the course of a recent radio address. He praised the spirit shown by the War Department in transferring the nitrogen laboratory and a large appropriation to the department having jurisdiction over the industry which has the dominant interest in nitrogen in times of peace.

Dr. Lind explained the various methods of nitrogen production in popular terms and pointed out that the United States, which consumes more nitrogen than any other country, with the exception of one, occupies tenth place among the producers.

At the nitrogen laboratory discarded guns are being used to furnish material for catalyzers, which Dr. Lind characterized as the latest application of the principle of heating swords into plowshares.

Tunisia An Important Source of Supply for Beeswax

Leland L. Smith, consul at Tunis, has forwarded a report which says it would appear as if American importers of raw beeswax would find an important source of supply in Tunis as a result of the depreciation of the franc, the currency of the country. It is reported that a certain proportion of the Tunisian product eventually reaches the United States in a refined state.

The quantity of beeswax produced in Tunis is highly variable, as a result of the uncertain climate of the country and fluctuates between 50,000 and 125,000 kilos per year. Tunis is almost exclusively an agricultural country but it is handicapped by an excessively dry climate. The production of beeswax is governed by the propitiousness of the agricultural season.

Less than one-half of the production is used locally. However, the proportion consumed in the country is increasing yearly and this accounts for the stationary position occupied by the export figures. The natives employ beeswax in the fabrication of candles which they use for religious purposes.

Japan Reduces Subsidies for Dye Industry

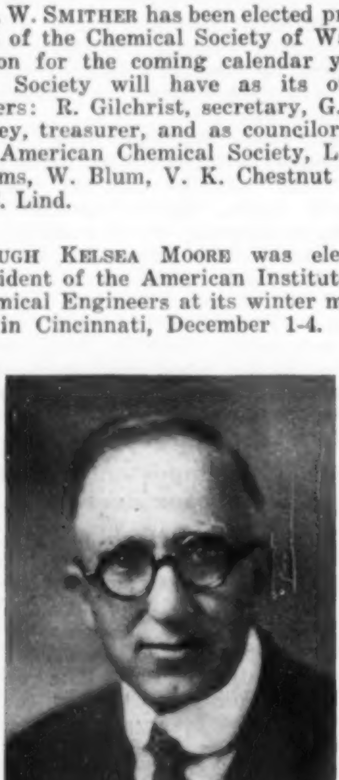
A message from Tokio says that a law has just been promulgated which appreciably modifies the policy followed by the Japanese Government regarding the national dye industry. Up to the present the government has granted an annual subvention of about 2,000,000 yen in the form of a guarantee of interest. The new law reduces the subvention by about one-half and confines government assistance to works producing certain kinds of dyes. The subsidies will be in proportion to the cost of manufacture and selling prices.

Men You Should Know About

GILBERT N. LEWIS, dean of the College of Chemistry, University of California, delivered the Silliman Lectures at Yale University on November 30, December 2, 4, 7, 9, 14 and 16. The subject of the lectures was "Concepts of Science."

F. W. SMITHER has been elected president of the Chemical Society of Washington for the coming calendar year. The Society will have as its other officers: R. Gilchrist, secretary, G. W. Morey, treasurer, and as councilors in the American Chemical Society, L. H. Adams, W. Blum, V. K. Chestnut and S. C. Lind.

HUGH KELSEA MOORE was elected president of the American Institute of Chemical Engineers at its winter meeting in Cincinnati, December 1-4. Dr. Moore, who is technical director of the Brown Co. of Berlin, N. H., received the Perkin medal in January, 1925, for outstanding achievement in industrial chemistry.



Dr. Hugh K. Moore

ANDREW IRVING ANDREWS has been appointed assistant professor of ceramic engineering at the University of Illinois, Urbana, Ill., and he assumed his duties at the beginning of the present term. While at Ohio State University where he completed work for his doctor's degree in 1924, Dr. Andrews held the Bureau of Mines fellowship and conducted an investigation of the use of dolomite in refractories.

JAMES READ has been appointed works manager in charge of plant operations for the Celite Products Co. at Lompoc and White Hills, California.

PROF. ERNST COHEN, director of the van't Hoff Laboratory at the University of Utrecht, Holland, will be visiting professor of chemistry at Cornell University during the second semester of the academic year, from February until June, 1926. He will give a series of lectures during this time. Prof. Cohen will be the first scientist to occupy the non-resident chair of chemistry recently established at the university.

DR. ALBERT SAUVEUR, professor of metallurgy, Harvard Engineering School, gave a series of three lectures at the Carnegie Institute of Technology, Pittsburgh, Pa., Nov. 30, Dec. 1 and 2.

EDWARD LA BELLE, chemist for the El Dorado Oil Works, San Francisco, Cal., has left for a trip to Manila in the interests of his company and will be absent for a number of months.

F. R. GERARD, chief engineer for the Boyne City Portland Cement Co., Boyne City, Mich., has resigned to accept a position in Lima, Peru.

JOHN F. QUEENY, chairman of the board of directors, Monsanto Chemical Works, Inc., St. Louis, Mo., has been re-elected representative from his city to the board of directors of the Mississippi Valley Association, devoted to inland waterways.

PROF. ALEXANDER SILVERMAN, head of the Department of Chemistry, University of Pittsburgh, has been elected a senator to represent the universities and colleges of Pennsylvania in the recently organized senate of chemical education of the American Chemical Society.

F. R. MCCRUMB, formerly of the Chemical Warfare Service and stationed at Edgewood Arsenal, has accepted a position as chief chemist for the LaMotte Chemical Products Company of Baltimore.

A. L. FEILD, who for a number of years has been a member of the technical staff of the Union Carbide and Carbon Corporation, first at Cleveland Works of the National Carbon Co., then at the Niagara Falls plant of the Electro Metallurgical Co., and more recently in the Union Carbide and Carbon Research Laboratories, Inc., Long Island City, has resigned to join the metallurgical staff of the United Alloy Steel Corporation, Mr. Feild, while working for the Bureau of Mines, was the first recipient of the J. E. Johnson, Jr., Award by the A.I.M.E. In his new position Mr. Feild will carry on experimental and development work in connection with the physical chemistry of steel.

WALTER RAUTENSTRAUCH, professor of mechanical engineering at Columbia University and consultant in management, has been elected president of the Fred F. French Co. of New York City.

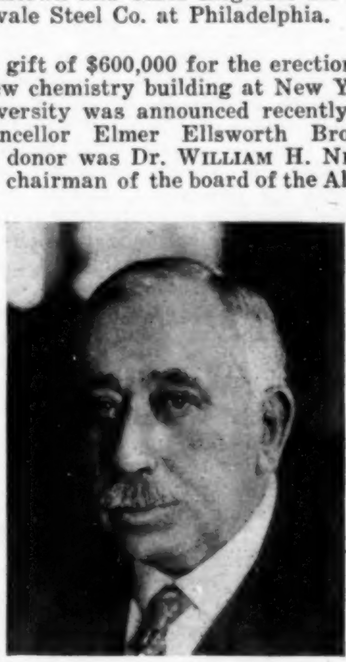
SAKAL KEITOKU, chemical engineering graduate of the University of Illinois class of 1916, is employed as a chemical engineer for the Shikama Chemical Co., Shikama, Hyogo-Ken, Japan, manufacturers of plasters, cements and water-proofing compounds.

W. J. NUGENT, vice-president and general manager of the Nugent Steel Castings Co., Chicago, was elected president to succeed Charles Piez at a recent meeting of the directors.

W. W. ODELL of the U. S. Bureau of Mines is now stationed at the San Francisco office of the Bureau. He is engaged in an investigation of the suitability of western bituminous coals for water-gas manufacture to replace the use of fuel oil now employed in the manufacture of oil gas. The work is being done under a co-operative scheme between the Bureau and the Pacific Coast Gas Association, working through the California Gas Research Council.

EMMETT B. CARTER is now with the Tannin Corporation in New York City. Until recently Mr. Carter has been chief engineer of the Barrett Co., located at their general offices in New York. Prior to that connnection Mr. Carter was employed as Construction engineers at the Cambria Steel Co., Johnstown and Chief Engineer for the Midvale Steel Co. at Philadelphia.

A gift of $600,000 for the erection of a new chemistry building at New York University was announced recently by Chancellor Elmer Ellsworth Brown. The donor was Dr. WILLIAM H. NICHOLS, chairman of the board of the Allied Chemical and Dye Corporation and a graduate of the College of Arts and Pure Science of the New York University Class of 1870. It is expected that work on the new building will start in the spring and it will be ready for occupancy by the beginning of the second semester of the college year, 1926-1927.



Dr. William H. Nichols

EDWIN C. ALFORD, for the past seven years an engineer with T. Shriver and Co., is leaving to take the position of eastern sales manager for the Duriron Company. After January 1 he will be located in their New York office in the Grand Central Terminal Building.

W. F. BARRETT was recently elected president of the Carbide and Carbon Chemical Corporation, a subsidiary of the Union Carbide Corporation. Mr. Barrett is also the president of the Linde Air Products Co. and the Prest-O-Lite Co., Inc., both of which are Union Carbide subsidiaries.

PROF. JAMES KENDALL, of the Department of Chemistry of Columbia University, delivered a lecture on "The Rare Earths" at the School of Chemistry of the University of Minnesota at Minneapolis on December 1. On December 5 he spoke on the same topic before a joint meeting of the New England Association of Chemistry Teachers, the Chemistry Teachers' Club of New York City and the New Haven Section of the American Chemical Society at Bridgeport, Conn.

Calendar

AMERICAN CHEMICAL SOCIETY, 71st meeting, Tulsa, Okla., April 5 to 9, 1926.

AMERICAN ELECTROCHEMICAL SOCIETY, Chicago Beach Hotel, Chicago, April 22, 23 and 24, 1926.

AMERICAN INSTITUTE OF CHEMICAL ENGRS., Berlin, N. H., June 21-24, 1926.

AMERICAN SOCIETY FOR STEEL TREATING, Winter Sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22, 1926.

CHEMICAL EQUIPMENT ASSOCIATION, Exposition, Cleveland, week of May 10, 1926.

AMERICAN CHEMICAL SOCIETY, regional meeting of New York State Sections at Niagara Falls, Jan. 29 and 30, 1926. Headquarters, Hotel Niagara.

Obituary

Dr. Charles Avery Doremus

Dr. Charles Avery Doremus, a charter member of the American Electrochemical Society, one of the founders of the Chemists' Club in New York, and a conspicuous figure in chemistry in the metropolitan district for two generations died of heart disease on December 2, 1925. Born in New York City in 1851, he was the son of Dr. Robert Ogden Doremus, the distinguished chemist for whom Doremus Hall, the chemistry building at the College of the City of New York, was named. It was at this institution that the younger Doremus received his collegiate training, graduating at the age of 19. By 1873 he had received degrees from the Universities of Heidelberg and Leipzig, and returned to America where he was employed as a reporter on photography to the United States Government. He wes engaged in private practice from 1874 to 1879, also serving during this time as assistant in chemistry, toxicology and medical jurisprudence in the Bellevue Medical School. From 1879 to 1882 he occupied a similar position with the University of Buffalo.

For 22 years prior to 1901 Dr. Doremus taught in the College of the City of New York as assistant professor of chemistry and physics. From 1901 to 1904 he served as acting professor of chemistry. After his retirement from teaching in 1905 Dr. Doremus was an active participant in the professional and social activities that have their center in the Chemists' Club of New York City.

FRANK B. KENNARD, 75, founder of the first paint and glass company in Omaha, and a resident there for sixty years, died Sunday, November 15 at his home in Fairacres. He had been ill for the past two years and for the past ten months had been confined to his bed, following a stroke of paralysis, from which he gradually grew weaker until his death. He organized the Kennard Paint and Glass Company in 1888. In 1892 he re-established the company. Surviving are his widow, three daughters and one son, Lee W. Kennard. He was born in New Athens, Ohio, April 28, 1850, came with his parents to Nebraska when a boy of 14, and has been there ever since.

JOHN S. MCELWAIN, pioneer paper manufacturer of the Connecticut Valley, died November 24, at the home of his son, 209 Linden Street, Holyoke, Mass., following an extended illness.

Mr. McElwain, prominent in business affairs for 75 years, was born in Middlefield, Mass., in 1828, and celebrated his 97th birthday the 18th of last March. He was an associated member of the first paper manufacturing mill to be established in Holyoke. This company was organized by J. C. Parsons, Aaron Bagg and Mr. McElwain and was known as the Parsons Paper Company.

EDWARD C. HOYT, formerly president of the Central Leather Company died at Stamford, Conn., November 27 at the age of 71.

Mr. Hoyt was born in New York in 1853 and early in life learned the tannery business in Pennsylvania. Soon after he was twenty he became a member of the Hoyt Brothers, who conducted a tannery. In 1893 this firm was taken over by the United States Leather Company and in 1902 Mr. Hoyt was elected president of the company. Later the concern was reorganized and incorporated as the Central Leather Company, and Mr. Hoyt remained as president until his retirement from active business in 1918. He remained a member of the board of directors until a year ago. He was also a director of the Park National Bank of New York and tendered his resignation to the officers of the bank the day before his death. Mr. Hoyt is survived by his wife, a daughter and two sons.

JOSIAH FRANCIS JOHNSON, manager, general engineering division of the South Philadelphia Works of the Westinghouse Electric and Manufacturing Co., died in the Chester hospital on Thursday, November 12. Death was caused by a cerebral hemorrhage.

Mr. Johnson was born July 15, 1879, at Ziongrove, Schuylkill County, Penna. He was graduated from the Bloomsburg High School and later from the Bloomsburg Normal School. Following this, he spent some time as a railroad telegraph operator, and at another period taught school. He then entered the Pennsylvania State College, from which he was graduated in 1905.

Industrial Notes

THE ROBERT JUNE ENGINEERING MANAGEMENT ORGANIZATION of Detroit has acquired control of the Electric Flow Meter Co. of Kansas City, Mo., formerly the Hyperbo-Electric Flow Meter Co. of Chicago, and will henceforth operate the business under its own management with executive offices at 8835 Linwood Ave., Detroit, Michigan. Robert June becomes president of the company; J. M. Naiman, formerly general manager becomes vice-president, consulting and chief engineer, with Major W. W. Burden of the Robert June organization as treasurer.

THE CHICAGO PNEUMATIC TOOL CO. of New York has effected arrangements with Motoren-Werke, Mannheim, Germany, whereby it has acquired the exclusive rights to manufacture and sell the Benz solid injection Diesel engine in the United States and Canada.

THE VITRIFIED IRON PRODUCTS CO., Clyde, Ohio, is a new company producing vitrified enameled iron evaporating and drying pans or trays for shelf, tunnel or vacuum driers and general chemical plant use.

BELL & GOSSETT CO. of Chicago, purveyors of a line of heat-treating materials and equipment, have just announced the establishment of a general industrial instrument department which will pay particular attention to the engineering phases of pyrometer installations. This department will be headed by C. C. McDermott, who will have R. E. Soules associated with him. The company has just completed a new large factory at 3,000 Wallace St., Chicago.

THE BROWN INSTRUMENT CO., Philadelphia, Pa., has opened the following offices: 215 East New York St., Indianapolis, Ind., with J. R. Green in charge, and Room 1108, Hippodrome Bldg., Cleveland, with G. S. Frazee, in charge.

THE AIR PREHEATER CORP., 25 Broadway, N. Y., manufacturers of the Ljungstrom air preheater, is a consolidation of James Howden & Co. of America, Inc., and the Ljungstrom interests of Stockholm, Sweden. The newly formed corporation takes over all Ljungstrom patent rights of the preheater, together with the shops of James Howden & Co. of America, Inc., at Wellsville, N. Y. B. G. Brolinson has been elected president of the new company and W. L. Batt, president of S K F Industries, is chairman of the board of directors.

THE CHEMICAL TREATMENT COMPANY, 26 Broadway, N. Y., has acquired the plant of the National Tube Company, Huntington av., Waterbury, Conn. The old tube equipment will be disposed of at once and equipment installed for the production of Crodon, an electro-plate chiefly composed of chromium.

Market Conditions and Price Trends

Distribution of Chemicals on Larger Scale Than a Year Ago

Deliveries Involve Large Amounts and Indicate Gains in Consumption —Production Also Ahead of Last Year

CONTRACT calls for heavy chemicals have been prominent and the movement of many selections from plants has been running well ahead of the totals for the corresponding period of last year. This is significant in view of the fact that the final quarter of 1924 found an active demand for chemicals. Seasonal conditions prevail in some instances and account for reports that requirements for certain chemicals is less than earlier in the year. But such reports refer largely to specialities and are not indicative of the general situation in the market.

Very satisfactory reports also was heard concerning the amount of contract business which has been placed for delivery over all or part of 1926. This predicates the existence of sound conditions in the industries which offer large outlets for chemical products and reflects the confidence of manufacturers in the stability of values for raw materials and in the potential markets for their finished products. It further places the chemical industry in an enviable position since it offers a guarantee of continued production at capacity, or close-to-capacity, plant operation with a fair percentage of the output sold ahead.

Increased consumption of chemicals and allied products also is shown by returns which have been made by the different branches of these industries. For instance, paper mills reporting to the American Paper and Pulp Association showed an increase of 8 per cent in October over September production. All grades of the output were in the increase. Production stood at 515,063 tons, of which, 134,991 tons were newsprint and 132,249 paper board. Month-end stocks amounted to 224,522 tons.

Wood pulp output for October increased 23 per cent over the preceding month to a total for all grades of 198,796 tons. Month-end stocks totaled 149,092 tons.

Building operations throughout October were of record proportions and this opened up an unusually heavy demand for window glass with the result that production of the latter has been greatly stimulated with demand, if anything, exceeding supply.

Another basis of computing the relative activity of producing and consuming trades is found in the figures for employment collected every month by the Department of Labor. The latest returns refer to October and they show that a larger number of workers was employed in the manufacturing industries than was the case in the preceding month. An exception was found in the case of rubber tires which had been expected to show a recession from the very active rate of operation which had been in effect for several months. The rate of progress made over October, 1924, was very marked and furnishes a fairly accurate mathematical proof of the increased outlets for chemicals in the present year. For the sake of comparisons, index numbers for employment are given below, covering the months of October and September, 1925, and October, 1924:

Index of Employment

	Oct., 1925	Sept., 1925	Oct., 1924
Dyeing and finishing textiles	100.7	96.9	94.1
Leather	90.8	90.1	87.5
Paper and pulp	94.9	92.7	93.1
Chemicals	94.7	93.4	89.0
Fertilizers	107.3	105.8	85.8
Glass	98.1	93.3	86.7
Automobile tires	109.2	118.0	106.1
Petroleum refining	98.4	98.9	89.6

There have been numerous changes in prices for chemicals during the month but the more important chemicals, from a standpoint of tonnage, have held on a fairly steady basis.

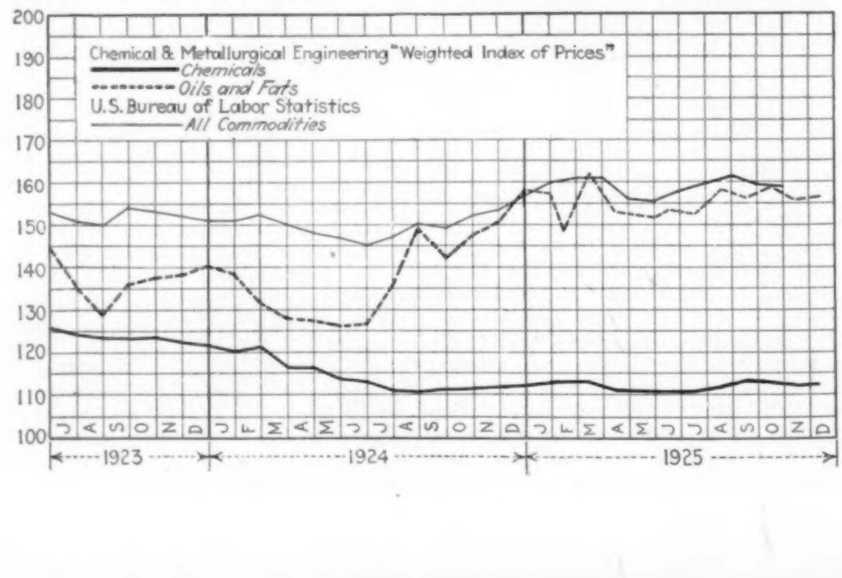
Weighted Index Number Higher

The weighted index number for chemicals now stands at 113.11 as compared with 112.77 a month ago and 112 a year ago. Weakness in anhydrous and aqua ammonia continued and the alcohols and miscellaneous chemicals had a bearish influence. A higher average level, however, resulted from advances in some of the coal-tar chemicals, sulphur products and stronger markets for some of the imported group due to the formation of selling agreements in primary markets. A review of the price situation does not reveal any decided tendency toward drastic changes in value and the establishment of contract prices for many selections has given a basis for computing future price levels.

The unusual demand for glycerine brought about higher price levels for this material and with Oriental oils in a strong position, the weighted index number for oils and fats made a slight gain for the month. The number is now 156.13. Last month the number was 155.69 and a year ago 157.56. Consumption of cottonseed oil has been heavy and despite the large ginning returns there has been a scarcity of crude oil. This has steadied nearby positions in the refined market but with the large visible supply of seed, the outlook is favorable for a lower market for crude and refined oil. Linseed oil has fluctuated within narrow limits and the seed situation does not point to any price recessions in the immediate future. Traders are looking for a break in prices for coconut oil and fats and greases do not appear to be any too strongly entrenched at current levels.

The chemical foreign trade for October showed a small advance, exports having risen 5 per cent from $13,390,000 in October, 1924, to $14,099.000 in October, 1925, and the imports, 6 per cent from $14,982,000 to $15,913,000. Several of the groups recorded smaller trade for the month than during the previous October. The falling off in the exports for some groups was due more to the size of the shipments in October, 1924, than to any marked decline this year. In October, 1924, trade was at the peak of the entire year.

Prominent in the import trade was the exceptionally large amounts of glycerin which came into the country during the month under discussion, a figure far in excess of any other single month, 4,656,600 lb. worth $548,900 having been imported. Other commodities showed the usual fluctuations, with gains in most of the items.



Market Conditions and Price Trends

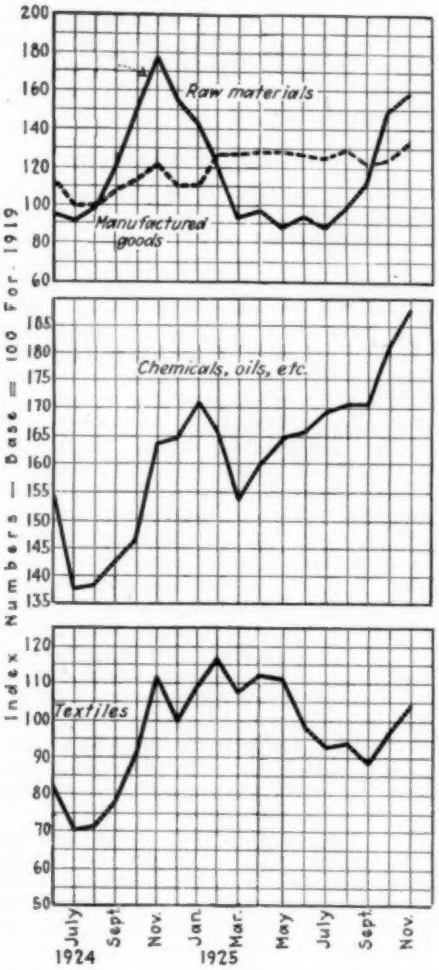
Facts and Figures of Business

in Chemical Engineering Industries

Industrial Statistics Presented Graphically for Those Who Follow the Monthly Trends of Production and Consumption

MANUFACTURING production in October reached a new high level at 132 per cent of the 1919 monthly average, according to the index number of the Department of Commerce covering sixty-four commodities, and was 14 per cent higher than in October, 1924. The largest increase over October, 1924, occurred in the miscellaneous group, with 33 per cent, due to the high output of automobiles, the other groups showing the following gains: Foodstuffs, 2 per cent, textiles 11 per cent, iron and steel 10 per cent, lumber 5 per cent, leather 6 per cent, paper and printing 5 per cent, chemicals 8 per cent, stone, clay and glass products 11 per cent, non-ferrous metals 4 per cent and tobacco products 7 per cent.

Volume of Production



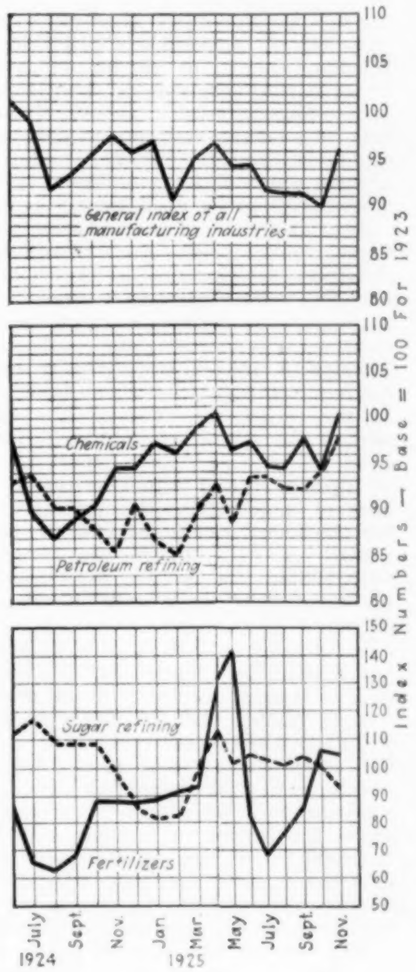
The output of raw materials increased seasonally but was 11 per cent less than in October, 1924. The marketings of animals and forestry products increased 4 per cent and 10 per cent, respectively, while the production of minerals decreased 1 per cent and crop marketings 19 per cent. The shutdown in anthracite mining and smaller grain receipts were responsible for the declines in these latter groups.

The index of unfilled orders of iron and steel and building materials on October 31 showed a slight increase over the end of September and was 23 per cent higher than a year ago, both the iron and steel and building materials groups increasing over October, 1924, though building material orders unfilled were less than on September 30, 1925.

The index number of stocks of commodities held at the end of October showed a decrease of 10 per cent from September, when allowance is made for seasonal variations and were 1 per cent less than a year ago. Only the manufactured foodstuffs group had larger stocks than at the end of September while, in comparison with a year ago, the foodstuffs groups, both raw and manufactured, declined, while other commodities were held in larger amounts.

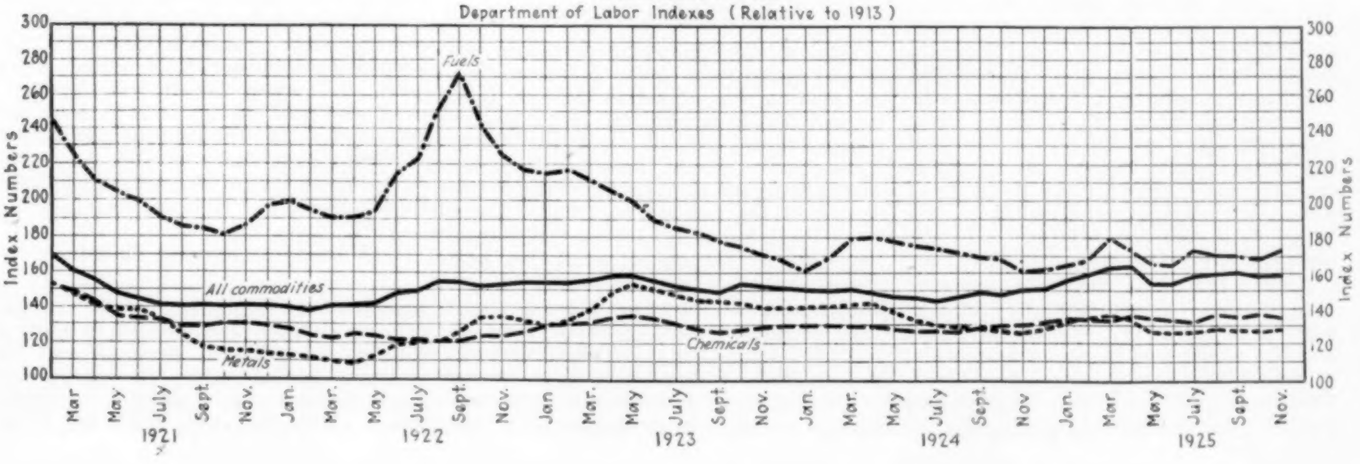
The index number of the Bureau of Labor, covering wholesale prices for groups of commodities was 158 for October which shows a lower average price level for that month as compared with September but a higher average than for October, 1924. The weighted number as referred to chemicals was 135 for October and 136 for September, while metals were represented by 128 as compared with 127 for the preceding month.

Index of Employment



Wholesale Prices

Department of Labor Indexes (Relative to 1913)



Market Conditions and Price Trends

Closing Period of Year Shows Bright Outlook for Chemicals

Activity in Consuming Trades Has Substantial Background Which Should Remain Over First Part of 1926

ADVICES received from trade sources during the past month have indicated a healthy condition in the chemical and allied industries. Production of chemicals has been large throughout the final quarter of the year. It has been commensurate, however, with the requirements of consumers and large volume of chemical output has not resulted in piling up surplus stocks at producing points. There is, and has been for some time, a large consumption of chemical products, there have been heavy placements of orders for 1926 delivery, and there are no weighty accumulations of raw materials hanging over the market.

The existence of such basic conditions speaks volume for the excellent conditions which obtain in the chemical industry. With general business on a high plane of activity without any indications of inflation, the position of consuming trades not only is satisfactory but points to a continued era of prosperity for at least the early part of the coming year. In addition to good business at home, export buying of chemicals and allied products has been of large volume, the official totals for the 10 months ended Oct. 31, being valued at $102,010,239 as compared with $93,885,249 for the corresponding period of 1924, or a gain in value in excess of 8.6 per cent.

Disturbing factors in the trade are not lacking but they have application only to separate commodities or groups. Among these may be cited the wood distillation chemicals. The market for the latter is not unduly excited but the development of competing synthetic products has caused some uncertainty about the future. A similar condition is found in the case of ammonia products but in the latter case competition has assumed definite form and market values have been affected accordingly.

The general firmness of prices also has been shaken at times by reports that price cutting tactics were employed in securing contract orders. Such reports have been heard recently in connection with sales of caustic soda. Bichromates also are included among the chemicals which have sold at prices below the open market quotations. But the latter usually shows an irregular price tendency during the contracting period with buyers of very large lots being dealt with on private terms depending on the keenness of competition.

Among the allied materials glycerine has assumed a commanding position because of the heavy buying movement and the sharp rise in prices which has accompanied the buying movement. The use of this material for anti-freeze purposes has placed a tax on producers to fill requirements and foreign markets have been called upon freely to make up the deficiency. The market, however, is not expected to retain its present strong position for any lengthy period and shortly after the turn of the year, prices may return to a more normal level.

> ***Leading Market Developments During the Month***
>
> **Heavy demand for glycerine brings about sharp advances in price and results in record importations from foreign markets.**
>
> **Reports from Germany say a sales agreement has been perfected among leading producers of tartaric acid.**
>
> **Scarcity of stocks has featured the markets for toluol, solvent naphtha, and xylene but larger supplies are promised.**
>
> **Competition among producers of aqua ammonia is still a factor in holding prices at the low levels recently reached.**
>
> **Domestic makers have named higher prices for barium chloride on contract and foreign markets are reported to be advancing.**

Interest in some of the chemicals of foreign origin has been heightened by statements that producers abroad had entered into agreements which practically unified control over sales. Oxalic and tartaric acids are specifically mentioned as coming under this class. No appreciable effects have been noted in the market for oxalic acid but quotations on tartaric acid for shipments from Germany have been higher than those quoted a short time ago and the probable result of such sales combinations will be reflected in increased sales prices.

Sulphur Prices Advanced

One of the important developments of the month was found in a marking up of prices for sulphur. The new quotations are on a basis of $17 a ton at mines and $21 per ton f.o.b. New York. This is the second increase in price within the year and is in contrast to the course of the market in 1924. Conditions underlying the higher prices are the lessened outputs of producers and the reduction of surplus stocks in sellers hands. In the first place production of sulphur last year dropped to 1,220,600 long tons from 2,036,097 long tons in 1923. Shipments were in excess of production and there was, in consequence, a decline in stocks, which at the end of 1923 were approximately 3,000,000 tons and at the end of 1924 were estimated at 2,700,000 tons. Exports in 1924 were regarded as heavy and amounted to 484,143 long tons. For the ten-month period Jan.-Oct., 1925, exports were 534,322 tons with outward shipments by the end of December expected to reach a total of 650,000 tons. With domestic demand heavy in addition to the increase in export buying, the market has been strengthened because production has been greatly reduced from level attained in 1923 when the output was 2,036,097 tons. In 1924 the output was 1,618,841 tons. There is therefore, a logical reason for the higher scale of prices now in effect and basic conditions are not such as to give hopes for any material gains in production in the near future.

Tartaric Acid Sales Agreement

Recent reports from abroad have stated that three important producers of tartaric acid in Germany had entered into an agreement by which a common selling agency would be maintained for the sale of this acid. German producers at different times have established sales agreements to regulate distribution and prices for tartaric acid but for some time the outputs of the different producers have been sold on an independent basis. With the change in the status of raw materials in this country, greater importance has attached to foreign markets as a source of supply. In consequence arrivals from abroad have been gaining in volume. Official figures place importations for the ten month period ended Oct. 31, at 3,467,133 lb. as compared with 2,608,120 lb. in the corresponding period of last year. It is noteworthy that during last October imports amounted to 1,046,580 lb. This represents shipments far in excess of the monthly quotas and also in excess of domestic monthly consumption. It would appear that these shipments were stimulated by the knowledge that a common sales agency abroad was to be set up and holders of stocks took this opportunity to send their surplus holding to consuming markets where their sale would be unrestricted by price or other ageements. The effect of the unified sales policy already has made itself manifest as a market factor as cable quotations for prompt and nearby shipments from abroad have been on a higher price level. As prices for domestic tartaric acid are held at premiums over the imported, it is evident that the action of foreign producers will be construed as a bullish factor on values in domestic markets.

Market for German Bromine

Attention was directed last month to reports of the dissolution of the convention which had been formed to control supply and sales of bromine and its products in Germany. A report has been forwarded by the trade commissioner at Berlin which gives details of

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.11**
Last month	112.77
December, 1924	112.00
December, 1923	121.54

Basic chemicals for the most part have held steady. Weakness in bichromates, ammonia, alcohols, and miscellaneous items has been offset by price advances in sulphur, sulphur compounds, and barium chemicals.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**156.13**
Last month	155.69
December, 1924	157.56
December, 1923	140.05

High prices for glycerine, combined with firmer markets for palm oils and linseed oil brought about a slight advance in the weighted index number, despite easier markets for corn, china wood, and oleo oils.

the market situation in that country. It states that bromine is made in Germany from the waste liquors from carnalite. In reducing 600 metric tons of normal carnalite about 350 kilos of liquid bromine may be obtained. In former years German bromine was sold at from 50 to 60 pfennings per kilo, but shortly before the war the producers formed a convention, and as a result, the price was raised from 2.50 to 3 marks per kilo, the present price. About 12 potash reduction plants are now making bromine, compared with 33 in former years. The principal prewar markets for German bromine were abroad, the United States being quite a large purchaser, but the present demand is considerably less due to the increased production facilities in France and the United States. The German bromine producers are placing great hopes in the development by the Badische Anilin & Soda Fabrik of the new "anti-knock" for internal combustion engines, ethylene dibromide, which contains a considerable amount of bromine. It is hoped that this will provide a profitable market for bromine, the production of which has been limited by the low demand. There have been no new developments in the local market for bromine and the situation as far as creating a wider consuming outlet is pretty much the same as is reported for Germany.

Methanol Imports Decline

Official figures showing imports of methanol were released recently. The latest figures cover imports for September. Early in the year the importance of foreign synthetic methanol as a competitor of the domestic product was stressed to an alarming degree. Sufficient time has elapsed to indicate at least that offerings from Germany have been on a decreasing scale. The following table gives details of importations:

	Gal.	Value
1924, Entire year	48	$29
1925, First quarter	122,906	56,422
Second quarter	185,178	84,622
July	7,847	3,865
August	48,410	21,493
September	8,413	3,941

On the other hand refiners of methanol in this country have been more active as is shown by the following figures which are established on data furnished by the refiners, to the Department of Commerce:

PRODUCTION OF REFINED METHANOL

United States	Produced, Gal.	Stocks (End of Month), Gal.
April	474,701	717,853
May	416,227	715,100
June	375,040	669,861
July	394,207	554,261
August	525,683	575,492
September	509,195	526,176
October	671,808	515,917
Canada		
April	36,680	68,477
May	27,965	50,344
June	16,793	51,551
July	22,000	52,459
August	....	32,007
September	26,898	40,129
October	11,500	32,443

While the above figures show a falling off in refining in Canada, they are encouraging as far as the United States is concerned as the returns for October not only tell of a material increase in production but also report a decline in stocks in hand at the end of the month which in turn is indicative of a better movement into consuming channels.

No Improvement in Ammonia

The past month has brought no improvement in conditions surrounding the market for aqua ammonia. For a short time the market steadied and quotations showed a tendency to react. Selling pressure soon asserted itself and prices quickly returned to the low levels which had been previously established. As current asking prices are on a basis of 3c. per lb. delivered, for carlots, the question of delivery costs must be recognized to understand how low in price this material has gone. Production costs and profits have been lost sight of, in the fight for market control. It is inevitable that a readjustment must follow although it is not easy to foretell how far off this is in accomplishment. In the meantime buyers are able to take on stocks at bargain prices and even though this is not an active season for this commodity, large amounts are reported to have been sold on contract.

China Wood Oil Consumption

In some quarters complaints have been voiced regarding the slow call for China wood oil. The theory has been advanced that increasing use of lacquers has been at the expense of varnishes of which wood oil is a component part. Undoubtedly it is true that production and consumption of pyroxylin varnishes and lacquers has made rapid strides but a glance at the import figures for China wood oil would warrant the belief that consumption of this material was on an unusually large scale. Imports for Jan.-Oct. this year amounted to 84,639,163 lb. as compared with 596,610,243 lb. for the corresponding period of 1924. Shipments from Hankow to this country in September were 9,750,000 lb. as compared with 6,850,000 lb. in September, 1924. Stocks of oil in this country are admitted to be large. The latest figures available are for Sept. 30, on which date stocks were 26,945,674 lb. but a large part of these were held by consumers who are accustomed to keep large supplies on hand in order to improve the quality. Actual consumption in the third quarter of the year is given at 19,696,708 lb. As imports during the present calendar year will approximate 100,000,000 lb. it is evident that the supply is running ahead of consuming needs but this is warranted by reports of small stocks at terminals in China and by the irregularity which frequently characterizes the movement of supplies from interior Chinese points.

Exports of Chemicals

	Oct. 1925	Oct 1924
Benzol, lb	1,216,728	17,165
Aniline oil and salt, lb	24,044	14,511
Acid, acetic, lb	48,602	114,118
Acid, boric, lb	109,381	119,749
Acid, sulphuric, lb	382,780	848,686
Methanol, gal	19,558	50,901
Aluminum sulphate, lb	3,115,979	3,075,493
Acetate of lime, lb	426,219	1,367,416
Calcium carbide, lb	406,224	396,769
Bleaching powder, lb	1,646,038	1,070,493
Copper sulphate, lb	350,237	368,846
Formaldehyde, lb	207,138	255,673
Potassium bichromate, lb	11,719	56,187
Sodium bichromate, lb	655,255	....
Sodium cyanide, lb	201,775	34,580
Borax, lb	3,384,715	3,224,501
Soda ash, lb	2,629,971	3,474,914
Sodium silicate, lb	4,067,552	3,869,344
Sal soda, lb	1,158,032	1,072,568
Caustic soda, lb	9,717,941	8,742,418
Sulphate of ammonia, ton	7,880	10,974
White lead, lb	1,032,831	1,793,551
Zinc oxide, lb	2,172,204	809,684

Imports of Chemicals

	Oct., 1925	Oct., 1924
Dead or creosote oil, gal	2,776,162	5,056,508
Naphthalene	....	220
Pyridine, lb	101,900	72,092
Arsenic, lb	1,715,588	1,304,872
Acid, citric, lb	11,200	6,720
Acid, formic, lb	102,864	98,022
Acid, oxalic, lb	231,585	276,500
Acid, sulphuric, lb	5,480,640	755,000
Acid, tartaric, lb	1,046,580	168,679
Ammonia chloride, lb	1,130,374	1,055,115
Ammonia nitrate, lb	818,473	125,459
Barium compounds, lb	1,801,076	1,184,189
Calcium carbide, lb	1,498,820	1,650,832
Copper sulphate, lb	404,800	128,400
Bleaching powder, lb	300,691	106,600
Potassium cyanide, lb	881,257	193,661
Potassium carbonate, lb	708,901	217,260
Potassium hydroxide, lb	1,129,576	1,677,878
Potassium chlorate, lb	760,428	619,780
Sodium cyanide, lb	1,483,780	1,791,700
Sodium ferrocyanide, lb	100,464	379,302
Sodium nitrite, lb	22,524	233,403
Sodium nitrate, ton	48,587	70,454
Sulphate of ammonia, ton	1,115	508

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to December 14.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.15 -$0.16
Acid, acetic, 28%, bbl.	cwt	3.12 - 3.37	3.00 - 3.25	3.12 - 3.37
Boric, bbl	lb.	.08½- .10	.08½- .10	.09 - .09½
Citric, kegs	lb.	.45½- .47	.45½- .47	.45½- .47
Formic, bbl.	lb.	.10 - .11½	.10 - .11	.11 - .11½
Gallic, tech., bbl	lb.	.45 - .50	.45 - .50	.45½- .47
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06½- .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.12½- .13
22%, tech., light, bbl	lb.	.06 - .06½	.06½- .07	.06 - .06½
Muriatic, 18°, tanks	cwt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.04 - .04½
Oleum, tanks, wks.	ton	17.50 -20.00	17.50 -20.00	16.00- 17.00
Oxalic, crystals, bbl.	lb.	.10¾- .11	.10¾- .11	.09½- .10
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks	ton	8.50 - 9.50	8.50 - 9.50	8.00 - 9.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl	lb.	.27½- .30	.27½- .30	.26 - .29
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.20 - 1.25
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	4.94 - 5.04	4.94 - 5.04	4.89 -......
Alcohol, Butyl, dr	lb.	.20 - .21	.217- .227	.30 -......
Denatured, 190 proof				
No. 1 special dr	gal.	.53½-......	.54½-......	.55 -......
No. 5, 188 proof, dr.	gal.	.53½-......	.53½-......	.55 -......
Alum, ammonia, lump, bbl	lb.	.03½- .04	.03¾- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.35 - 1.40
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.35 - 2.45
Aqua ammonia, 26°, drums.	lb.	.03 - .04	.05 - .06	.06½- .06¾
Ammonia, anhydrous, cyl	lb.	.15 - .17	.15 - .17	.28 - .30
Ammonium carbonate, powd. tech., casks	lb.	.08½- .10	.08½- .10	.12½- .12¾
Nitrate, tech., casks	lb.	.08 - .08½	.08 - .08½	.09 - .10
Sulphate, wks.	cwt.	2.95 -	2.95 -....	2.70 -......
Amylacetate tech., drums	gal.	2.45 - 2.60	2.75 - 3.25	3.35 - 3.50
Antimony Oxide, bbl.	lb.	.17 - .17½	.17 - .18	.13 - .13½
Arsenic, white, powd., bbl	lb.	.03½- .04½	.03½- .04½	.06½- .07
Red, powd., kegs	lb.	.12 - .12½	.12½- .13	.14¾- .15½
Barium carbonate, bbl	ton	45.00 -54.00	45.00 -54.00	54.00 -58.00
Chloride, bbl.	ton	58.00 -66.00	58.00 -66.00	65.00 -72.00
Nitrate, cask.	lb.	.07½- .08½	.07½ - .07½	.08 - .08½
Blanc fixe, dry, bbl	lb.	.03¾- .04	.03¾- .04	.03¾- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	1.90 - 2.00	1.90 -......
Borax, bbl.	lb.	.05 - .05½	.05 - .05½	.05½- .05¾
Bromine, cs.	lb.	.45 - .47	.45 - .47	.44 - .45
Calcium acetate, bags	cwt.	3.00 - 3.05	3.00 - 3.05	3.00 - 3.05
Arsenate, dr	lb.	.07 - .08	.07 - .08	.08 - .09
Carbide drums.	lb.	.05½- .06	.05½- .06	.06¾- .07
Chloride, fused, dr., wks.	ton	21.00 -......	21.00 -......	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07½- .07¾	.07¼- .07½
Carbon bisulphide, drums.	lb.	.06 - .06½	.06 - .06½	.06 - .06½
Tetrachloride drums	lb.	.07 - .07¼	.07 - .07¼	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04½-......
Cylinders.	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans.	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	13.30 -14.00	13.00- 14.00	15.00 -16.00
Copper carbonate, bbl	lb.	.17 - .18	.17 - .18	.17 - .17½
Cyanide, tech., bbl	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.50 - 4.60	4.50 - 4.60	4.50 - 4.65
Cream of tartar, bbl.	lb.	.21½- .22	.21½- .22	.21 - .21½
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags.	cwt.	1.30 - 1.40	1.30 - 1.40	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.82 - .85	.87 - .90	.92 - .95
99%, dr.	gal.	1.05 -......	1.05 -......	1.08 - 1.10
Formaldehyde, 40%, bbl	lb.	.09 - .09½	.08¾- .09	.09 - .09½
Furfural, dr.	lb.	.20 - .23	.20 - .23	.25 -......
Fusel oil, crude, drums.	gal.	2.25 - 2.40	2.40 - 2.50	2.90 - 3.00
Refined, dr	gal.	3.25 - 3.50	3.25 - 3.50	4.00 - 4.50
Glaubers salt, bags.	cwt.	1.15 - 1.25	1.15 - 1.25	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.25 - .26	.21½- .22	.18¾- .19
Lead:				
White, basic carbonate, dry, casks	lb.	.10¾-......	.11 -......	.10½-......
White, basic sulphate, sck.	lb.	.10 -......	.10¼-......	.10 -......
Red, dry, sck	lb.	.12¾-......	.12 - .12½	.12¾-......
Lead acetate, white crys., bbl.	lb.	.14½- .15	.14½- .15	.15½-......
Lead arsenate, powd., bbl	lb.	.13 - .14	.13 - .14	.16 - .18
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 -......
Litharge, pwd., csk	lb.	.11¾-......	.11½- .12	.11¾-......
Lithopone, bags.	lb.	.05½- .06	.06 - .06½	.06 - .06½
Magnesium carb., tech., bags.	lb.	.06½- .07	.06¾- .07	.07 - .08
Methanol, 95%, dr	gal.	.57 - .62	.57 - .62	.74 - .76
97%, dr.	gal.	.59 - .64	.59 - .64	.76 - .78
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.14 -......	.14 -......	.15¼-......
Phosphorus, red, cases	lb.	.68 - .70	.70 - .75	.70 - .75
Yellow, cases	lb.	.34 - .36	.34 - .36	.37½- .40
Potassium bichromate, casks.	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.05¾- .06	.05 - .05½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.06¾- .08
Cyanide, cs.	lb.	.52 - .54	.55 - .58	.47 - .62
First sorts, csk.	lb.	$0.08¾-$0.09	$0.08½-$0.09	$0.08¼-$0.08½
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07¼- .07½
Muriate, 80% bgs	ton	34.90 -......	34.90 -......	34.55 -......
Nitrate, bbl.	lb.	.06¼- .06½	.06¼- .06½	.06 - .07¼
Permanganate, drums.	lb.	.14 - .15	.14½- .15	.14 - .15
Prussiate, yellow, casks	lb.	.18 - .18½	.18 - .18¼	.16½- .17
Sal ammoniac, white, casks.	lb.	.06 - .07	.05¾- .07	.06 .06¼
Salsoda, bbl.	cwt.	1.10 - 1.30	1.20 - 1.40	1.20 - 1.40
Salt cake, bulk.	ton	15.00 -18.00	15.00 -18.00	16.00 -17.00
Soda ash, light, 58%, bags, contract	cwt.	1.38 -......	1.38 -......	1.38 -......
Dense, bags.	cwt.	1.45 - 1.55	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.10 -......	3.10 -......	3.10 -......
Acetate, works, bbl.	lb.	.04¾- .05	.04¾- .05	.05 - .05½
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Bichromate, casks.	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Bisulphate, bulk.	ton	4.50 - 5.00	4.50 - 5.00	6.00 - 7.00
Bisulphite, bbl	lb.	.03¾- .04	.03¾- .04	.04½- .04½
Chlorate, kegs	lb.	.06¼- .06½	.06¼- .06½	.06½- .07
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.20 - .22
Fluoride, bbl.	lb.	.08¾- .09	.08¾- .09	.08½- .09
Hyposulphite, bbl	lb.	.01¾- .02½	.01¾- .02½	.02 - .02½
Nitrite, bags.	cwt.	2.63 -......	2.60 -......	2.42½-......
Nitrate, casks.	lb.	.09½- .09¾	.08¾- .09	.09¼- .09½
Phosphate, dibasic, bbl.	lb.	.03¼- .03½	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums.	lb.	.10 - .10½	.10½- .10¾	.09¾- .10
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03 - .03½	.03 - .03¼	.02¾- .03
Sulphite, crys., bbl	lb.	.03 - .03½	.02¾- .03	.02¾- .03
Strontium nitrate, bbl.	lb.	.08 - .08½	.08 - .09	.09 - .09½
Sulphur, crude at mine, bulk.	ton	16.00 -17.00	15.00 -16.00	14.00 -16.00
Chloride, dr	lb.	.05 - .05½	.04½- .05	.04½- .05
Dioxide, cyl	lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag	cwt.	2.70 - 3.00	2.35 - 2.80	2.25 - 2.35
Tin bichloride, bbl.	lb.	.17¾-......	.17¾-......	.15 -......
Oxide, bbl.	lb.	.66 -......	.62 -......	.58 -......
Crystals, bbl.	lb.	.43 -......	.43 -......	.37½-......
Zinc chloride, gran., bbl.	lb.	.06½- .07	.07¾- .08	.06 - .07½
Carbonate, bbl.	lb.	.09½- .10	.10¼- .11	.12 - .14
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.09 - .10	.10 - .10½	.08 - .08½
Zinc oxide, lead free, bag.	lb.	0.07¼-......	0.07¼-......	0.07¼-......
5% lead sulphate, bags.	lb.	.07 -......	.07 -......	.06¾-......
Sulphate, bbl	cwt.	3.00 - 3.50	3.00 - 3.50	3.00 - 3.25

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.15 -$0.15½	$0.15½-$0.16	$0.17 -$0.17½
Chinawood oil, bbl.	lb.	.13 - .13½	.13½- .13¾	.15½- .16
Coconut oil, Ceylon, tanks, N. Y.	lb.	.12 -......	.12 -......	.10½-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.09¾-......	.10 -......	.10½-......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08¾-......	.08¾-......	.08¾- .09
Linseed oil, raw, car lots, bbl.	gal.	.96¾-......	.96 -......	1.11 -......
Palm, Lagos, casks	lb.	.09½-......	.09½-......	.09¾- ....
Niger, casks	lb.	.08¾-......	.08¾-......	.08¾-......
Palm Kernel, bbl.	lb.	.11 - .11¼	.11 - .11¼	.10½-......
Peanut oil, crude, tanks (mill)	lb.	.10 -......	.10 -......	.12 -......
Perilla, bbl	lb.	.15½- .15¾	.15 - .15½	.14½-......
Rapeseed oil, refined, bbl.	gal.	.93 - .94	.93 - .94	.97 - .99
Sesame, bbl.	lb.	.15 - .15¼	.15 - .15½	.14½-......
Soya bean tank (f.o.b. Coast)	lb.	.10¾-......	.11½-......	.11½-......
Sulphur (olive foots), bbl.	lb.	.09 -......	.09 -......	.09½- .09¾
Cod, Newfoundland, bbl	gal.	.64 - .66	.62 - .64	.64 - .66
Menhaden, light pressed, bbl	gal.	.72 - .74	.67 - .69	.70 - .72
Crude, tanks (f.o.b. factory)	gal.	.55 -......	.55 -......	.55 - .58
Whale, crude, tanks	lb.	....-......	.07¼-......	....
Grease, yellow, loose.	lb.	.09 -......	.09 -......	.09 -......
Oleo stearine	lb.	.14 -......	.13½-......	.12 -......
Red oil, distilled, d.p. bbl.	lb.	.11¼- .11½	.11¼- .11½	.09 - ....
Tallow, extra, loose.	lb.	.10 -......	.09¾-......	.10¼-......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl	lb.	$0.06 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.90 - .95	.90 - .95	.75 - .80
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.16 - .16½	.17 - .17½	.16 - .16½
Aniline salts, bbl	lb.	.20 - .22	.20 - .22	.20 - .21
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.70 - .75
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.20	1.15 - 1.20	1.50 -......
Benzidine base, bbl	lb.	.72 - .74	.75 - .77	.78 - .80
Benzoic acid, U.S.P., kgs.	lb.	.60 - .62	.60 - .62	.75 - .85
Benzyl chloride, tech, dr	lb.	.25 - .26	.30 - .31	.35 - .36
Benzol, 90%, tanks, works.	gal.	.23 - .28	.24 - .29	.23 - .28
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks	gal.	.53 - .55	.53 - .55	.62 - .64
Diethylaniline, dr	lb.	.55 - .60	.55 - .57	.59 - .61
Dinitrophenol, bbl.	lb.	.30 - .33	.30 - .33	.35 - .38
Dinitrotoluen, bbl	lb.	.15 - .17	.16 - .17	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl.	lb.	.48 - .50	.48 - .50	.48 - .50
H-acid, bbl.	lb.	.68 - .72	.72 - .73	.70 - .74

Coal-Tar Products—Continued

		Current Price	Last Month	Last Year
Naphthalene, flake, bbl.	lb.	$0.05¾-$0.06	$0.05 -$0.05½	$0.05 -$0.05½
Nitrobenzene, dr	lb.	.09½- .10	.09½- .10	.09 - .10
Para-nitraniline, bbl	lb.	.58 - .60	.59 - .61	.68 - .70
Para-nitrotoluine, bbl.	lb.	.35 - .36	.35 - .36	.40 - .42
Phenol, U.S.P., drums	lb.	.22 - .24	.22 - .24	.24 - .26
Picric acid, bbl.	lb.	.25 - .26	.25 - .26	.20 - .22
Pyridine, dr	lb.	4.15 - 4.25	4.30 - 4.35	4.00 - 4.10
R-salt, bbl.	lb.	.40 - .44	.40 - .44	.50 - .55
Resorcinal, tech, kegs.	lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl	lb.	.33 - .34	.33 - .34	.32 - .33
Solvent naphtha, w.w., tanks	gal.	.35 -......	.26 -......	.24 - .25
Tolidine, bbl.	lb.	.90 - .95	.95 - .96	1.00- 1.05
Toluene, tanks, works	gal.	.35 -......	.26 -......	.26 -......
Xylene, com., tanks	gal.	.31 - .36	.26 - .27	.25 - .27

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl.	ton	$22.00-$24.00	$17.00-$17.50	$16.90-$17.00
Casein, tech., bbl.	lb.	.13½- .14	.13 - .13½	.10½- .11
China clay, powd., f.o.b. Ga.	ton	10.00 -20.00	12.00 -15.00	14.00 -20.00
Imported, powd.	ton	45.00 -50.00	45.00 -50.00	45.00 -50.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.08 - .08½	.07 - .07½	.08 - .09
Prussian blue, bbl	lb.	.34 - .36	.34 - .36	.35 - .37
Ultramine blue, bbl.	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl.	lb.	.28 - .30	.28 - .30	.28 - .30
Carmine red, tins.	lb.	5.00 - 5.10	4.90 - 5.00	4.50 - 4.70
Para toner.	lb.	.90 - .95	.90 - .95	.95 - 1.00
Vermilion, English, bbl.	lb.	1.45 - 1.50	1.40 - 1.45	1.30 - 1.35
Chrome yellow, C. P., bbl.	lb.	.18 - .18½	.18 - .18½	.17 - .17½
Feldspar, No. 1 (f.o.b. N. C.)	ton	6.00 - 6.50	5.50 - 6.00	6.50 - 7.00
Graphite, Ceylon, lump, bbl	lb.	.08½- .09	.08½- .09	.05½- .06
Gum copal, Congo, bags.	lb.	.09½- .10	.08½- .10	.09 - .14
Manila, bags.	lb.	.14 - .16	.14 - .16	.18 - .19
Damar, Batavia, cases	lb.	.29½- .30	.25 - .26	.27½- .28
Kauri, No. 1 cases.	lb.	.57 - .65	.60 - .65	.60 - .65
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -41.00	35.00 -42.00	35.00 -40.00
Pumice stone, lump, bbl.	lb.	.04½- .06	.04½- .08	.05 - .05½
Imported, casks.	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, B-H.	bbl.	14.50 -	15.55 -	7.50 -
Turpentine	gal.	1.03 -	1.11 -	.84 -
Shellac, orange, fine, bags.	lb.	.72 - .73	.55 - .57	.66 - .67
Bleached, bonedry, bags.	lb.	.59 - .62	.59 - .62	.74 - .76
T. N. bags.	lb.	.48 - .49	.49 - .51	.63 - .64
Soapstone (f.o.b. Vt.), bags.	ton	9.00 -10.00	7.00 - 7.50	7.00 - 8.00
Talc, 200 mesh (f.o.b. Vt.)	ton	11.00 -......	11.00 -......	10.50 -......
200 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	8.00 -12.00
325 mesh (f.o.b. N. Y.)	ton	14.75 -......	14.75 -......	14.75 -......
Wax, Bayberry, bbl.	lb.	.20 - .21	.20 - .22	.21 - .21½
Beeswax, ref., light.	lb.	.44 - .45	.43 - .44	.36 - .37
Candelilla, bags	lb.	.32 - .33	.30 - .31	.30 - .31
Carnauba, No. 1, bags.	lb.	.50 - .51	.43 - .44	.36 - .37
Parafine, crude 105-110 m.p.	lb.	.05¾- .06	.06 - .06¼	.06¼-......

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-......	$200.00-......	$200.00-......
Ferrochromium, 1-2%	lb.	.23- .35	.23- .35	.30-......
Ferromanganese, 78-82%	ton	115.00-......	115.00-......	105.00-......
Spiegeleisen, 19-21%	ton	33.00-34.00	32.00-33.00	32.00-......
Ferrosilicon, 10-12%	ton	33.00-38.00	33.00-38.00	39.50-43.00
Ferrotungsten, 70-80%	lb.	1.14- 1.20	1.15-......	.85- .90
Ferro-uranium, 35-50%	lb.	4.50-......	4.50-......	4.50-......
Ferrovanadium, 30-40%	lb.	3.25- 4.00	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic.	lb.	$0.14 -$0.14¼	$0.14¼-$0.14	$0.14½-$0.14¾
Aluminum, 96-99%	lb.	.28 - .29	.28 -	.27 - .28
Antimony, Chin. and Jap.	lb.	.20½- .21	.20 - .20½	.14½- .14¾
Nickel, 99%	lb.	.34 -......	.34 -......	.29 - .30
Monel metal, blocks	lb.	.32 - .33	.32 - .35	.32 - .33
Tin, 5-ton lots, Straits	lb.	.63½-......	.62½-......	.54¾-......
Lead, New York, spot	lb.	.09¼-	.09¼-	.09 -
Zinc, New York, spot	lb.	.09¼-......	.09½-......	.07¾-......
Silver, commercial	oz.	.69½-	.70½-	.69¼-......
Cadmium	lb.	.60 -	.60 -	.60 -
Bismuth, 508-lb. lots.	lb.	2.65 - 2.70	2.65 - 2.70	1.50 - 1.55
Cobalt	lb.	2.50 -......	2.50 -......	2.50 - 3.00
Magnesium, ingots, 99%	lb.	1.00 -......	1.00 -......	.90 - .95
Platinum, ref	oz.	120.00-	120.00-	117.00-......
Palladium, ref.	oz.	78.00- 83.00	78.00- 83.00	78.00-......
Mercury, flask 75	lb.	91.00	88.00-......	70.50-
Tungsten powder.	lb.	1.20	1.20-	.95- 1.00

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post.	ton	20.50- 23.50	20.50- 23.50	18.50- 24.00
Coke, fdry., f.o.b. ovens.	ton	3.75- 4.25	3.75- 4.25	4.00- 4.50
Fluorspar, gravel, f.o.b. Ill.	ton	16.00- 18.00	16.00- 18.00	17.50- 18.50
Ilmenite, 52% TiO_2, Va.	lb.	.01½-......	.01½-......	.01½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.42 - .44	.42 - .44	.39 - .41
Molybdemite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.65 - .70	.65 - .70	.65- .70
Monazite, 6% of ThO_2.	ton	120.00-......	120.00-......	120.00-......
Pyrites, Span. fines, c.i.f.	unit	.12½-......	.12½-......	.11½- .12
Rutile, 94-96% TiO_2	lb.	.12 - .15	.12 - .15	.12 - .15
Tungsten, scheelite, 60% WO_3 and over.	unit	12.50 -13.00	12.50 -13.00	9.00 -
Vanadium ore, per lb. V_2O_5.	lb.	1.00 - 1.25	1.00 - 1.05	1.00 - 1.25
Zircon, 99%	lb.	.03 -......	.03 -	.06 - .07

Current Industrial Developments

New Construction and Machinery Requirements

New England

Conn., Bridgeport—H. Isaacs, 226 Oak St., is having plans prepared for the construction of a 2 story, 60 x 75 ft. hide and tallow factory on Asylum St. Estimated cost $40,000. H. Koerner, 164 State St., is architect.

Conn., Middletown—Wesleyan University awarded contract for the construction of Hall Memorial laboratory on campus to Tracy Bros., 52 Benedict St., Waterbury. Estimated cost $350,000. Former contract rescinded.

Mass., Arlington (Boston P. O.)—Arlington Dye Works, 411 Highland Ave., Somerville, is having plans prepared for the construction of a 1 story dye plant including naphtha house, examining rooms, etc., here. Estimated cost $40,000. E. Porter, 40 Mystic Ave., Medford, is architect.

Mass., Cambridge (Boston P. O.)—Cambridge Rubber Co., 748 Main St., will soon award contract for the construction of a 2 story, 42 x 90 ft. factory on State St. Estimated cost $40,000. J. R. Worcester & Co., 79 Milk St., Boston, are architects and engineers.

Mass., Chelsea (Boston P. O.)—Panco Rubber Co., Highland St., awarded contract for the construction of a 1 story, 50 x 60 ft. factory to J. Slotnick, 448 Broadway. Estimated cost $40,000.

Mass., East Dedham (Dedham P. O.)—Metropolitan Charcoal Co. plans the reconstruction of plant on Whiting Ave. recently destroyed by fire. Estimated cost $40,000. Architect not selected.

Mass., Hudson—Firestone-Apsley Rubber Co. plans the construction of a 1 story rubber factory. Estimated cost $40,000. Architect not selected.

Mass., Lynn—General Electric Co., 920 Western Ave., awarded contract for the construction of a 1 story, 60 x 100 ft. oxygen hydrogen building, to Charles W. Wright Co., 23 Central Ave.

Mass., West Springfield (br. Springfield)—New England Smelting Co., I. Brown, Pres., 220 Union St., awarded contract for the construction 1 story, 125 x 135 ft. addition to plant, to Meyer Miskin, 619 Dickinson St., Springfield. Estimated cost $60,000.

Mass., Woburn—J. J. Riley Co., Salem St., awarded contract for the construction of 3 story, 50 x 98 ft. tannery, on Salem St., to S. Andreason, Montvale Rd. Estimated cost $15,000.

Middle Atlantic

Del., Wilmington—The Jessup & Moore Paper Co., Commercial Tribune Bldg., Philadelphia, Pa., awarded contract for the construction of a 39 x 361 ft. machine room extension to the Augustine Mills here to Morton C. Tuttle Co., 862 Park Square Bldg., Boston, Mass.

Md., Edgewood—The Chemical Warfare Service, Edgewood Arsenal, will receive bids until Dec. 21, for 5,500 lb. aluminum chloride anhydrous and 6,000 lb. monochloracetic acid (cir. 11).

N. J., Gloucester — Forrest Mercerizing Co. awarded contract for the construction of a 2 story manufacturing plant including a 44 x 119 ft. mill, 20 x 34 ft. boiler house, 33 x 35 ft. office building, etc., at Essex St. and Pennsylvania R.R., to E. E. Hollenback, Inc., 1824 Brandywine St., Philadelphia, Pa. Estimated cost $50,000.

N. J., Westwood — Mayor and Borough Council, W. L. Best, Clk., will receive bids until Dec. 15 for the construction of sewage treatment works consisting of a grit and screen-chamber, settling and dosing tank, sand filters, sludge drying beds, laboratory, etc. T. F. Bowe, 110 William St., New York, N. Y., is consulting engineer.

N. Y., Elmira—International Rayon Co., c/o A. J. Sauer & Co., 1506 Race St., Phila., Pa., Archts., having plans prepared for the construction of 160 x 270 ft. and 108 x 160 ft. plant, near here. Estimated cost with equipment $1,200,000.

Pa., Beaver Falls—Mayer China Co. is receiving bids for the construction of a 1 story, 120 x 120 ft. addition to plant. Estimated cost $50,000. Private plans.

Pa., Beech Creek—Reed Mfg. Co., E. R. Reed, Pres., is receiving bids for the construction of a 2 story, 90 x 115 ft. candy plant on Main St. to replace fire loss. Estimated cost $115,000. New candy making equipment will be required.

Pa., Hercules (Belfast P. O.)—Hercules Portland Cement Corp., 1600 Walnut St., Philadelphia, awarded contract for the construction of a 2 story, 65 x 120 ft. pack house here to Austin Co., Jefferson Bldg., Philadelphia.

Pa., Johnstown—Bethlehem Steel Co. will soon receive bids for the construction of a coke preparing and mixing plant. Estimated cost $500,000. A. T. Keller, Bethlehem, is engineer.

Pa., Oaks—Philadelphia Rubber Works Co., Land Title Bldg., Philadelphia, will receive bids until Dec. 19, for the construction of a plant here, including 80 x 100 ft. dry dock storage, 35 x 65 ft. pigment storage, 70 x 100 ft. debeading and chopping plant, 80 x 80 ft. washer and grinder, 90 x 160 ft. devulcanizer, and 50 x 220 ft. mill, etc. Estimated cost $400,000. Osborn Engineering Co., Euclid Bldg., Cleveland, O., is engineer.

Pa., Uniontown—Tucson Steel Co., Oliver Bldg., Pittsburgh, Engr., will build a 1 story addition to radiator plant including testing and enamel departments here for Richmond Radiator Co. Estimated cost $46,000. Owner is in the market for 4 enameling ovens and 4 molding machines.

Pa., Williamsburg—West Virginia Pulp & Paper Co., 200 5th Ave., New York, N. Y., awarded contract for the construction of 80 x 170 ft. finishing and store room at plant here to Morton C. Tuttle, Co., 862 Park Square Bldg., Boston, Mass.

South

Ala., Pelham—Superior Lime & Hydrate Co. is in the market for equipment for the manufacture of concrete tile, block pipe and concrete products.

Fla., Clewiston—B. D. Dahlberg, Pres. Celotex Co., 645 Michigan Ave., Chicago, Ill., having preliminary plans prepared for a sugar refinery here. Estimated cost $10,-000,000. Smith & Ames, 15 William St., New York, N. Y., are engineers.

Ga., Dalton—The Dalton Brick & Tile Co., plans the construction of 8 tunnel dryers, 4 kilns, etc., to increase output to 40,000 brick and 60 ton building tile per day.

La., Elizabeth—Calcasieu Sulphate Paper Co., R. M. Hallowell, Pres., will build a 1 story addition to paper mill, capacity 35 ton Kraft wrapping paper daily. Estimated cost $300,000. Work will be done by day labor under the supervision of J. E. Ryberg, constructing engineer. Contract for machinery has been awarded.

La., Morgan City—Dixie Paper & Pulp Co., E. I. McIlhenny, Pres., et.al., New Orleans, plan the construction of a plant for the manufacture of paper and paper pulp from paille fene grass.

North Carolina and Tennessee—H. Margerum, 1120 Riverside Ave., Trenton, N. J., has purchased the plants of Erwin Feldspar Co., at Erwin, Tenn., and Spruce Pine, Yancy, Mitchel, and Avery Counties, N. C., and plans enlarging them for the manufacture of pottery, enamelware, blass, washing powder, etc. Estimated cost $800,000.

Tenn., Johnson City—American Bemberg Co. awarded contract for the foundations for 246 x 651 ft. artificial silk plant to Hughes Foulkrod Co., Commonwealth Bldg., Philadelphia, Pa. Bids for superstructure will be taken later.

Va., Fort Eustis—Quartermaster U. S. Army, is receiving bids Dec. 15, 300 lb. anhydrous ammonia, 10,000 lb. calcium chloride and 500 lb. bicarbonate of soda.

Va., Pulaski—Pulaski Foundry & Mfg. Corp. is in the market for a core oven and air compressor.

W. Va., East Steubenville (Mail Willsburg)—Wheeling Steel Corp., Wheeling Steel Corp Bldg., Wheeling, having plans prepared for the construction of a byproduct coke plant including 57 byproduct ovens, increasing capacity from 1,000 to 1,700 tons daily. $1,000,000. Private plans.

W. Va., Parkersburg—Viscose Co., Marcus Hook, Pa., awarded contract for the construction of a plant on Little Knawber river near here to J. Pettijohn, Lynchburg, Va. Estimated cost $2,000,000.

Middle West

Ill., Granite City—Midland Coke & Iron Corp., 117 North 4th St., St. Louis, Mo., awarded contract for 5,000 kw. unit electric power plant and 3,500 ton steel capacity blast furnace, here. to Riter-Conley, Inc., Oliver Bldg., Pittsburgh, Pa. Estimated cost $2,500,000.

Ill., Rock Island — Service Rubber Co. awarded contract for the construction of a 3 story, 84 x 132 ft. rubber products plant at Second St. and Fifteenth Ave. to M. A. Floyd Co., 430 Oak Grove St., Minneapolis, Minn., $163,221.

Ill., Roxana (East Alton P. O.)—Roxana Petroleum Corp., Arcade Bldg., St. Louis, Mo., has purchased two 80 acre sites and plans addition to existing refinery group, including new storage tanks, equipment, etc. here. Estimated cost $3,000,000. Private plans.

Ill., Warsaw—City Clerk takes bids Jan. 26 for 250 g.p.m. rapid sand filter plant with auxiliary equipment, etc. Estimated cost $33,000. E. Flad & Co., 1312 Chemical Bldg., St. Louis, Mo., is engineer.

Mich., Detroit—Vitrified Metallic Tile Co., 3326 Scotten Ave., N. Burgett, Pres., will purchase electric enameling furnace for making vitrified roof tiles.

O., Alliance—Stewart Bros. Paint Co., J. S. Stewart, Pres., is having plans prepared for the construction of a 2 story, 40 x 80 ft. factory. Estimated cost $40,000. Albrecht & Wilhelm, Union Bldg., Cleveland, are architects.

O., Ashtabula — Aetna Rubber Co., awarded contract for the construction of a 2 story factory to H. K. Ferguson Co., 6300 Euclid Ave., Cleveland. Estimated cost $50,000.

O., Barberton—Akron Rubber Reclaiming Co., Norton Ave., plans the construction of new units for plant, here, with complete equipment. Estimated cost $400,000. C. E. Bishop, Purch. Agt.

O., Cleveland—The Arco Co., S. D. Wise, Pres., 6408 Euclid Ave., awarded contract for the construction of a 1 story, 45 x 100 ft. addition to factory for the manufacture of paints, varnishes and enamels on East 79th St., to A. A. Lane Construction Co., 1869 East 55th St. Estimated cost $40,000.

O., Cleveland—Cleveland Railway Co., G. L. Radcliffe, V. pres., Hanna Bldg., is having plans prepared for the construction of a 4 story garage and laboratory building at Central Ave. near East 9th St. Estimated cost $200,000. W. Watson & Associates, 4614 Prospect Ave., are architects.

O., Cleveland—Vitrolite Co., C. A. Myers, Pres., 2907 Detroit Ave., is readvertising for bids for the construction of a 2 story, 44 x 147 ft. factory and warehouse for the manufacture of white tile. Estimated cost $60,000. A. B. Sylvanus & Co., 6014 Euclid Ave., are architects. Former bids rejected.

O., Cleveland—The White Motor Co., T. R. Dahl, Secy., 842 East 79th St., awarded contract for the construction of a 1 story, 40 x 200 ft. heat treating plant to George A. Rutherford Co., 2725 Prospect Ave. Estimated cost $100,000.

O., Columbus—City Purchase Bd. authorized to purchase 4,000 ton soda ash, 8,000 ton lime, 500 ton sulphuric acid, 8 ton chlorine and 350 ton bauxite, for waterworks purification plant for 1926.

O., Grandview Heights (Columbus P. O.) Bd. of Education having plans prepared for the construction of a 2 story, 112 x 126 ft. high school, including chemistry laboratory, here. Estimated cost $175,000. W. H. Tremaine, Chamber of Commerce Bldg., Columbus, is architect.

O., Newark—Pharis Tire & Rubber Co., A. R. Lindorf, Pres., 765 West Main St., awarded contract for the construction of a 2 story, 80 x 105 ft. addition to factory, to E. H. Latham Co., 60 East Broad St. Estimated cost $75,000.

O., Wadsworth — Wadsworth Salt Co., plans the construction of a 1 and 3 story factory including boiler house and engine room. Estimated cost $150,000. W. D. Spengler, 1053 Union Trust Bldg., Cleveland, is architect and engineer.

O., Wooster—Coxon Bleek China and Illuminating Co., plans the construction of 1 story, 50 x 175 ft. plant for the manufacture of china. Will purchase clay mixing machinery, etc. Estimated cost $45,000.

Wis., Appleton — Kimberly-Clark Co., Neenah, awarded contract for the construction of a 3 story, 55 x 95 ft. addition to paper mill, to C. R. Meyer & Sons Co., 50 State St., Oshkosh. Estimated cost $40,000.

Wis., Appleton—Water Comn., F. R. Morris, Secy., will receive bids until Dec. 16 for 150 ton of sulphate of aluminum and 3,000 lb. of liquid chlorine.

Wis., Milwaukee—Northwestern Malleable Co., 756 Park St., is in the market for a large annealing oven.

Wis., Milwaukee—Plastic Products Co., 123 Reservoir Ave., awarded contract for the foundation of a 1 and 2 story, 76 x 200 ft. factory on Port Washington Road to J. L. Stanage, 3526 Cedar St.

Wis., Milwaukee—Wisconsin Paint Mfg. Co., 454 33rd St., awarded contract for the construction of a 2 story, 40 x 82 ft. factory on Richards St., to Jahns & Knuth, 1331 28th St. Estimated cost $40,000. Special machinery will be installed.

West of Mississippi

Minn., Minneapolis—Dept. of Administration and Finance, State Capitol, St. Paul, awarded general contract for the construction of a 2 story, 50 x 110 ft. addition to laboratory for State University, here, to Albee Bros., 621 Plymouth Bldg. $55,870.

Minn., Montgomery — Minnesota Valley Canning Co., awarded contract for the construction of a factory, to J. B. Nelson Construction Co., 503 Belgrade Ave., Mankato. $150,000.

Minn., St. Paul—State Board of Administration and Finance, Capitol, St. Paul, is having plans prepared for the construction of 3 story chemistry building for University of Minnesota. Estimated cost $250,000. C. H. Johnston, 715 Capital Bank Bldg., is architect. Equipment for biochemistry laboratory will be required.

Mo., St. Louis—Barton Mfg. Co., 311 South 13th St., Waco, Tex., awarded contract for the construction of a 2 story, 130 x 170 ft. shoe polish plant at Kingshighway and Brown St., here, to Widmer Engineering Co., Laclede Gas Bldg., St. Louis. Estimated cost $100,000.

Neb., Minatare — Wyoming-Nebraska Sugar Co., subsidiary of the Holly Sugar Co., Colorado Springs, Colo., plans the construction of two 600 to 800 ton sugar beet factories, one here and one at Torrington, Wyo. $2,500,000 available.

Okla., Haskell—Oklahoma Natural Gas Co., 1 East 36th St., plans the construction of a compressor plant to replace fire loss.

Okla., Okmulgee—Independent Oil & Gas Co., will build addition to oil refinery, to increase output from 1,200 to 2,000 bbl. daily, also a lubricating oil and wax plant. Work to be done with company forces. Estimated cost $500,000. L. F. Silsbee is engineer. Owner will purchase cracking process stills, lubricating oil vats and condensers.

Okla., Tulsa—Sinclair Oil & Gas Co., Sinclair Bldg., is in the market for compressors, internal combustion engines and cooling apparatus to double capacity of the Garber casinghead gasoline plant.

Far West

Calif., Colton—California Portland Cement Co., Pacific Mutual Bldg., Los Angeles, awarded contract for the construction of a 1 story, 62 x 500 ft. mill on Colton St., to Austin Co., 777 East Washington St., Los Angeles. Estimated cost $50,000.

Calif., Los Angeles—Thomas Paper Converting Co., 1201 South Main St., is having plans prepared for the construction of a 1 story, 100 x 148 ft. factory at Santee and Washington Sts. Estimated cost $80,-000. Austin Co., 777 East Washington St., is architect and engineer.

Canada

Ont., Elk Lake—C. M. McCarthy, plans the construction of a plant for the development and manufacture of china and fireclay products at Kaolin City.

Ont., Norwich — Norwich Electric Fixtures, wants prices on equipment for foundry for the manufacture of brass and aluminum castings. Estimated cost $10,000.

Incorporations

The General Carbonalpha Co., Dover, Del., carry on experiments in laboratory work in industrial and scientific fields, $12,-060,000.

The Limestone Calcium Products Co., Dover, Del., mining of coal, stone, clay, $400,000.

United Rock Asphalt Co., Dover, Del., $1,500,000. (Corporation Trust Co. of Delaware.)

United Wood Treating Corp., Dover, Del., manufacture "Wolman Process" of Wolman Salts, $1,500,000.

Willette Wood Products Co., Dover, Del., manufacture paper board, $750,000.

American Therapeutic Gas Co., Wilmington, Del., scientific gas, $2,000,000. (Corporation Trust Co. of America.)

Florida Portland Cement Co., Wilmington, Del., $12,500,000. (Corporation Trust Co. of America, Dover, Del.)

Gillician Chipley Co. of Georgia, Wilmington, Del., manufacture resin, $1,092,-000. (Corporation Trust Co. of America.)

Phoenix Portland Cement Corp., Wilmington, Del., $2,500,000. (Corp. Trust Co. of America.)

Hunter Co., Peapack-Gladstone, N. J., manufacturing jellies, etc., $65,000. C. A. Hunter, B. E. Hunter, N. C. Hunter, Peapack, N. J.

Larvex Corp., Brooklyn, N. Y., mothproofing processes, 200,000 common, no par. S. S. Jennings, Jr., J. D. Vancott, R. E. J. Corcoran, Brooklyn, N. Y. (Attys., Sushmore, Bisbee & Stern, 61 Broadway, Manhattan.)

B. Altman Soap & Chemical Works, manufacture, 1,000 shares, no par. B. Altman, Secaucus, N. J., A. Buxenbaum, W. J. Speilberger, New York, N. Y. (Attys., Kirk & Diamond, New York, N. Y.)

Everlive Rubber Corp., New York, N. Y., $600,000. P. W. Quinn, M. M. McAlevey. (Atty., C. E. Lebarbier, 19 West 44th St.)

Bio Labro Products, New York, N. Y., chemists, $1,000,000. M. A. Keller, R. C. Penglase. (Atty., A. Collins, 31 Nassau St., New York, N. Y.)

Otello & Bitmo, New York, N. Y., paints, 5,000 shares, $5 each, 8,000 common, no par. A. C. and A. N. Holzapfel, J. A. Nardini, New York. (Attys., Townsend & Kindlebarger, 31 Nassau St., New York.)

Niagara Coke Corp., Niagara Falls, N. Y., 1,000 common, no par. P. A. and J. F. Schoellkopf, Jr., A. Smith, Niagara Falls, N. Y. (Attys., Cohn, Chormann & Franchot, Niagara Falls, N. Y.)